# East Fork of the Illinois River

# Watershed Analysis

# *Terrestrial Module*

US FOREST SERVICE
Illinois Valley Ranger District

BUREAU OF LAND MANAGEMENT
Grants Pass Resource Area

JULY 2000

# *Terrestrial Module*

## TABLE OF CONTENTS

## FIGURES



## TABLES

## APPENDICES

# Maps in the Terrestrial Section

# I. INTRODUCTION AND A BRIEF SUMMARY OF KEY FINDINGS

The focus of this section of East Fork of the Illinois Watershed Analysis is the identification of habitat conditions to which different species are adapted and to make recommendations as to how to restore and maintain these conditions. Another focus is the identification of fire hazard conditions and timber availability.

Timber and other commodities contribute to the local economy. However, levels of some habitat types (such as saplings, poles, and young forests) are higher than what might be desirable. The watershed also has a high percentage of fire intolerant plants (such as white fir) and high to moderate fire hazard. On the other hand, some habitat types such as old growth forest, interior mature and old growth forest, pine/oak savanna, and grass/forb are less frequent than might be desirable, and fire tolerant plants such as sugar pine and ponderosa pine are declining in abundance.

A single issue both threatens the maintenance of the certain important habitat types and retards their recovery to historical conditions: current high stand densities. Abnormally high densities of small trees (<32” dbh), compared to reference conditions, create a fire hazard that threatens maintenance of most of these habitats. It also retards tree growth and, therefore, retards the recovery of old growth forest and interior mature and old growth forest habitat. High stem densities also contribute to the decline of pine/oak savanna and grass/forb habitats, create higher insect and disease infestations (especially in 32"+ dbh pines), increases fire hazard in the rural interface (adjacent to private land and homes), reduces timber yield over time, and changes the species composition of the various plant communities.

# II. TERRESTRIAL CORE (KEY) QUESTIONS

The core questions used to focus this analysis are listed below. Section V of this module addresses each question in turn.

T-1. What are the existing conditions, what were the historic conditions, what are the trends, and what are the desired future conditions for:

- The relative abundance and distribution of wildlife species of concern in the watershed (i.e., threatened or endangered species, special status species, species emphasized in other plans).
- The distribution and abundance of their habitats.
- The processes that affect these species and their habitats?

T-2. Where and how has fire affected the watershed, and where and how could fire affect the watershed in the future?

T-3. What are the historic disturbance patterns for the watershed? How have management activities affected these patterns? In what way and how well does the watershed manage disturbance?

T-4. What is the existing condition of fire hazard on the perimeter of the rural intermix, and what can be done to improve those fire hazard conditions?

T-5. How much timber has been harvested in the watershed in the past? How much timber volume is available on the lands allocated to Matrix?

T-6. How has and how will stand densities and tree pathogens affect the watershed? Where are the Port-Orford-cedar root disease infection centers within the watershed and what can be done to minimize or prevent the spread of this disease?

T-7. What are the road networks and road maintenance needs for managing recreation, fire, timber sales, and habitats for species of concern?

T-8. Where are the priority areas for terrestrial maintenance and restoration treatments?

T-9. What are the historic and existing conditions and the trends for geologic and soil conditions in the watershed? What can be done to restore and maintain desired conditions?

T-10. What are the historic and existing conditions and the trends for botanical resources of concern in the watershed? What can be done to restore and maintain desired conditions?

T-11. What and where are the conflicts between various resources in terms of treatment recommendations? How can recommendation conflicts be mitigated or minimized?

# III. KEY TERRESTRIAL FINDINGS

Private citizens own 28% of the watershed. The majority of the watershed, 72%, is public land. The Siskiyou National Forest manages 63% of the watershed and the BLM manages 9%.

This watershed analysis found that, when compared to historic / reference conditions, the East Fork Illinois River watershed, like many other watersheds on the eastern portions of the Siskiyou Mountains, currently has higher amounts of:

- Small diameter trees (< 32” dbh);
- Tree mortality from competition, insects, and disease (especially pines and shade intolerant hardwoods);
- Fire hazard;
- Risk of landslides;
- Roads that adversely impact erosion processes (especially in Dunn creek); and
- Adverse effects to rare plants from noxious weeds, road and vehicle impacts, and the encroachment of vegetation.

Conversely, when compared to historic / reference conditions, there are currently lower amounts of certain ecosystem elements:

- Big trees (old growth, >32”dbh with > 40% canopy closure) (USDA/USDI 1994: FSEIS Vol. 1., p. 3&4-26);
- Interior mature and old growth forest habitat;
- Grasses and forbs;
- pine / oak savannah;
- pine species, and
- Low intensity fire.

The disparity between historic and current conditions puts many resources at risk, from old growth forest habitat to water quality. This disparity can be primarily attributed to timber harvest of old growth forest stands, road construction, mining, rural development, and fire suppression / exclusion. Most forest habitats are not developing as they did historically because tree densities are now much higher, diameter growth is slower, and species composition is shifting towards fire intolerant and shade tolerant species such as white fir and tanoak (Tappeiner et al. 1997; Sensenig 1998).

Reducing the density of trees could help restore reference ecological conditions, thereby improving ecological resilience and the safety of rural communities (from catastrophic high intensity fires). Stand density reduction could also accomplish the following goals:

- Increase the growth rate of smaller trees, which accelerates the restoration of mature and old growth forest habitat;
- Reduce the risk of mortality to mature and old growth forest from wildfire, competition induced mortality, and insect and disease attacks;
- Increase the amount of fire tolerant/shade intolerant species;
- Restore and maintain savanna, meadow, and forest under-story grass/forb habitats;

- Reduce the potential for catastrophic fires in the rural interface.

To achieve desired stand density conditions, potential tools include manual, mechanical or prescribed fire treatments.

Past timber harvest, roading, and mining have altered historic erosion processes. Historically, landslides delivered more large wood into streams than more recent landslide events. Timber harvest of large diameter trees (>32" dbh) has reduced the potential for delivery of these larger trees with landslides. Large wood is important for water quality (*e.g.*, sediment storage) and fish habitat. Roads constructed across streams have also reduced the potential for delivery of large wood and cobble to fish bearing streams and have increased the potential for diversion of streams out of normal drainage systems - which increases the delivery of fine sediments to streams. Historic placer mining activities, especially in the lower reaches of the watershed, removed a large amount of vegetation (see Social Module) and displaced a great deal of soil.

Out of seventy-four recently recorded (since 1964) debris slides or debris flows on National Forest System (NFS) lands in the watershed, the majority (50) occurred in the Dunn Creek drainage and most are associated with existing roads. The other area of significant past debris slide activity is the Chicago Creek/Chicago Peak area, where 10 debris slides were recorded and where the largest slide is located. However, none of the sub-watersheds within the East Fork Illinois watershed seem to be immune to mass wasting events. Past mass wasting / slides are is evident throughout the watershed. Many recent failures have occurred on sites of ancient failures.

# IV. SUMMARY OF TERRESTRIAL RECOMMENDATIONS

The general objective of these recommendations is to maintain and / or restore the distribution and abundance of ecosystem components (*e.g.*, vegetation types and habitats) to historic levels or the reference condition. It should be kept in mind that these conditions may not be consistent with the resource allocations and management objectives of the current or future resource management plans.

Inherent in these recommendations is the assumption that the reference conditions are were within the average range of natural variability. The type or intensity of treatments can and will vary for different land allocations. For example, treatments that help maintain or restore old growth forest could be emphasized in Late-Successional Reserves and Riparian Reserves. LSR and Riparian Reserve allocations, combined with wilderness, make up about 55% of the watershed. This would not be a primary management emphasis on the Matrix (about 17%) and private land (about 28%) that make up the rest of the watershed. The recommendations are summarized in Table T-1.

It is important to keep in mind that these recommendations do not constitute management decisions for federal lands. The recommendations may conflict or contradict one another. They are intended as a point of departure for project specific planning and evaluation work. Project planning then includes the preparation of environmental assessments and formal decision records as required by the National Environmental Policy Act (NEPA). It is within this planning context that resource conflicts would be addressed and resolved and the broad recommendations evaluated at the site specific or project planning level. Project planning and land management actions would also be designed to meet the objectives and directives of the Siskiyou NF's LRMP and the BLM's RMP.

Table T-1: Recommendations Summary for Terrestrial Ecosystem Components

| **Ecosystem Component** | **Recommendations for Maintenance and Restoration of Wildlife Habitat Elements, primarily NFS and BLM administered lands** |
|---|---|
| Grass/Forb<br><br>(Currently there are fewer acres of this habitat than in the reference condition ) | - Under-burn young, mature, and old growth forests, as well as pine/oak savannas.<br>- Burn regeneration harvest units hot enough to provide a seed bed for grasses and forbs.<br>- Remove encroaching woody vegetation from meadows with manual, mechanical, and/or prescribed fire treatments. Maintain meadows with prescribed fire.<br>- Use native species when seeding disturbed areas.<br>- A number of meadow restoration opportunities exist.<br>– See Map 25: Special Wildlife Areas (National Forest)<br>– See Map 9A: BLM Plant Series. All Jeffrey pine, ponderosa pine, and white oak sites, as shown on the plant series map, are candidates for savannah restoration. |
| Shrub Dominated<br>(Currently there are fewer acres of this habitat than in the reference condition ) | Use prescribed fire, manual, or mechanical treatments in openings and under-story of forest habitats to reduce current fuel ladder conditions, to reduce shrub levels on serpentine sites and to increase grass. |
| Seed/Sap/Pole<br><br>(Currently there are many more acres of this habitat than in the reference condition , over 5,000 more) | - Use timber harvest (regeneration or widely spaced thinning) and prescribed and natural fire to create this habitat. *Widely spaced or variable thinning and under-burning is preferred until old growth forests are restored in the watershed; i.e., avoid regeneration harvest of old growth.*<br>- Extend the time which seedling-sap-pole habitat provides grass, forb, and shrub habitat for 180 associated species (Brown et al. 1985) with treatments such as manual release and pre-commercial thinning. Priority areas are wildlife winter range (*i.e.*, south aspects with < 40% slope and < 3000 feet elevation). |

Table T-1: Recommendations Summary for Terrestrial Ecosystem Components

| **Ecosystem Component** | **Recommendations for Maintenance and Restoration of Wildlife Habitat Elements, primarily NFS and BLM administered lands** |
|---|---|
| Young Forest<br>(9-21" Dbh)<br><br>(Currently there are 600+ more acres of this habitat than reference) | - Increase diameter growth in young forest stands to accelerate the restoration of old growth forest habitat.<br>- Maintain hardwoods, especially shade-intolerant species at target levels of approximately 70 stems / acre in the matrix and 100 stems / acre in the riparian reserves.<br>- Reduce fire hazard to this habitat by reducing ground and under-story fuels, fuel ladders, the density of over-story crown and by increasing the distance to over-story crown (to reduce crown fire potential) (Agee 1997).<br>Priority areas are:<br>a) Upland (driest) portions of Riparian Reserves and adjacent to intermittent and ephemeral streams;<br>b) Sites adjacent to<br>•Roads (for use as control points and to improve economic feasibility),<br>• Wilderness areas (to facilitate letting natural fires burn inside wilderness),<br>• Private land / rural interface,<br>• Sites within or adjacent to connections between interior mature and old growth habitat (especially those at lower elevations or occupied by northern spotted owls) see Map 13: Current Interior / Mature and Old Growth.<br>Excellent opportunities to treat young forest habitat exist in Elder, Little Elder, Page, Chapman, and portions of Dunn Creek drainages within both managed and unmanaged stands. |
| Late-Successional Forest:<br><br>Mature Forest<br>(21-32" Dbh)<br><br>Old Growth Forest<br>(>32" dbh)<br><br>Interior Mature and Old Growth, patches > 20 ac. in size (400ft. edge effect).<br><br>(Currently there is more than the reference amount of mature, but less than half of reference amounts of old growth and interior habitats). | *On National Forest land*:<br>- Increase the overall abundance of old growth forest habitat on non-serpentine sties in the watershed, especially trees > 45" dbh.<br>- At the watershed scale, manage such that 45-75% of the non-serpentine sites is in late-successional (mature and old growth) forest habitat (On National Forest land 40% of which should be old-growth)<br>- In Riparian Reserves, manage such that 50-80% of the area is in mature and old growth forest habitat (45% old-growth on National Forest – see Table T-2).<br>- At the stand scale, manage to provide 8-16 mature conifers per acre, 8-16 old-growth trees per acre, and an appropriate amount of hardwoods (Bingham and Sawyer, 1991), amount of trees > 45" dbh per acre is a DATA GAP. A significant percentage of the large trees should have defect or deformities such as cavities, large limbs, and witch's brooms (from mistletoe).<br><br>Increase the size of interior mature and old growth forest patches and the connectivity between patches.<br>- Thinning and/or prescribed fire should, in the short term, help to maintain mature and old growth habitat conditions; and in the long term hasten restoration of mature and old-growth habitat (Agee, 1997).<br>- Priority habitats to treat for restoration of old-growth forest habitat are: 1) mature, 2) young, and 3) seed-sap-pole.<br>•Priority locations for restoration are adjacent to or connections between interior mature and old-growth forest and within Riparian or Late-Successional Reserves.<br>• For the long term, priority locations for restoration of old growth are within Riparian or Late-Successional Reserves.<br>• Maintaining mature forest in Matrix is consistent with timber management objectives, but maintaining old growth habitat is not; therefore, restoration of old growth habitat is less likely in Matrix.<br><br>- Reduce fire hazard to mature and old growth forest habitat. Priority areas are where the fire hazard is moderate or high within interior mature and old growth habitat patches (especially the largest patches), and in Riparian and Late-Successional Reserves. The location of interior habitat patches with moderate or high fire hazard is a DATA GAP. However, the location of young, mature, and old growth habitat that has moderate fire hazard is shown on Maps 21A and 21B: Fire Hazard Levels / Rating. Treatments could include manual, mechanical, or prescribed fire, or let wildfire burn when conditions are appropriate. |
| Cliffs, Rock outcrops, Caves, Adits, and Talus | - Maintain the majority as undisturbed areas. |
| Dead Wood: Large Woody Material and Snags | - Meet Siskiyou National Forest Guidelines (USDA Forest Service, 1996) or, where appropriate, use "A Field Guide to the Tanoak and the Douglas-fir Plant Associations in Northwestern California" (USDA 1996) or use "Snag Densities on the Gasquet Ranger District, Six Rivers National Forest, California" (USDA 1989). Specific data for East Fork Illinois watershed is a DATA GAP. |

Table T-1: Recommendations Summary for Terrestrial Ecosystem Components

| Ecosystem Component | Recommendations for Maintenance and Restoration of Wildlife Habitat Elements, primarily NFS and BLM administered lands |
|---|---|
| Pine/Oak Savanna | - Reduce encroachment and maintain savannas by burning as frequently as needed (about every 5 years).<br><br>- Priority locations are anywhere this habitat is found. This habitat is more common in the lower elevations on BLM lands, primarily on the west side of the watershed and lower portions of Chapman Creek. On National Forest land, it is most often found on foothills adjacent to the valley bottom; *e.g.*, lower Page Creek and some south aspects near lower Dunn Creek. |
| Fire | - Restore or maintain the historic fire regime where compatible with resource objectives.<br>- Develop a wilderness fire management plan for the Siskiyou Wilderness (joint plan by the Klamath, Siskiyou, and Six Rivers National Forests).<br>- Reduce fire hazard to the Siskiyou Wilderness; facilitate the use of prescribed natural fire in the Wilderness.<br>- Reduce fire hazard to the rural interface.<br>- Reduce fire hazard to interior mature and old growth forest habitat patches.<br>- Reduce fire hazard to young plantations and other early seral patches (tree-form vegetation).<br>- Break up the fuels continuity (in moderate to high fire hazard areas) within the Longwood Fire area.<br>- Maintain a road system in the watershed that permits efficient wildfire suppression and economical fuel hazard reduction treatments. |
| Timber and Vegetation | *NFS Matrix*<br>- Produce a commercial timber yield.<br>- Maintain an appropriate distribution and abundance of age classes to ensure a sustained production of forest products across the Forest.<br>- Provide early-successional wildlife habitat.<br>- Maintain a diversity of species, such as pines and hardwoods, appropriate for the site.<br>- Commercially thin stands to maintain desired species composition and stand structure, promote long-term tree and stand health, reduce fire hazard, and salvage potential mortality.<br>- Pre-commercially thin/release young stands to maintain desired species, stand structure and development rates. Treat stands early (within 10 years of stand initiation) to reduce potential fire hazard from fuel accumulations.<br><br>*BLM Matrix*:<br>- Produce a commercial timber yield and other forest commodities.<br>- Provide connectivity (along with other allocations such as Riparian Reserves) between Late-Successional Reserves.<br>- Provide habitat for a variety of organisms associated with both late-successional and younger forests.<br>- Provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees.<br>- Provide early-successional habitat. |
| Port-Orford Cedar | - Restore POC distribution and abundance on National Forest Lands;<br>- Maintain current disease control strategies per current guidelines (e.g., education, eradication, vehicle washing, etc);<br>- Finish the commercial sanitization on roads 4803 and 4808;<br>- Improve the road surface and drainage on the Sanger Peak tie road;<br>- Restrict wet season access on the 4808.019 spur with either a gate or a barricade; and<br>- Maintain or improve drainage and road surfaces to reduce POC infestation risk on open roads with POC present.<br>- Eradicate potential infection areas, sanitize other roads and areas as needed. Protect un-infested areas. |
| Root Diseases (other than POC - *Phytophthora lateralis*) | - Maintain tree vigor. Minimize root disease effects by favoring resistant species adapted to the sites and sanitation treatments. |

Table T-1: Recommendations Summary for Terrestrial Ecosystem Components

| **Ecosystem Component** | **Recommendations for Maintenance and Restoration of Wildlife Habitat Elements, primarily NFS and BLM administered lands** |
|---|---|
| Soils | - Manage roads to reduce their contribution to erosion processes such as landslides, surface erosion, stream diversion, and gully formation. Minimize or avoid new road construction on granitic or serpentine soils.<br>- Decommission unnecessary roads as identified through the agency prescribed interdisciplinary processes. To minimize soil disturbance or gully formation, evaluate the appropriateness of ground disturbing restoration techniques such as scarification and ripping. Evaluation should include but is not limited to parameters such as slope gradient, aspect and soil type.<br>- Numerous recent failures are associated with older landslide forms. Map ancient and inactive erosional forms to help guide future management decisions.<br>- On granitic and ultramafic soils, minimize or avoid soil disturbance by using appropriate and site-specifically determined logging systems, road location and design, prescribed fire, silvicultural, and restoration techniques.<br>- During the upcoming revision of the Siskiyou National Forest Plan, re-examine the amount of exposed mineral soil allowed for ground disturbing activities, especially in ultramafic soils, and ensure that what constitutes "exposed" mineral soil is well defined, e.g., does cover include overstory and/or surface rocks?<br>- Monitor fire effects on ultramafic soils to determine short and long term erosion hazards following burning. |
| Botany | - Noxious weeds:<br>-- Eradication of some weeds will involve removal of those weeds and revegetation of those same sites. Priority locations include the Happy Camp/Waldo Road Highway corridor, especially the areas infected with knapweed, wild sweet peas, Dyers woad, and the scotch broom along several of the main roads in the valley.<br>-- Map weeds as projects are planned and implemented to diminish the threat to sensitive plant populations in the future in this area.<br>-- Re-vegetate road corridors and around parking areas with native species, as these areas are rehabilitated. Add local species for seed collection to the WCF procurement plan. Work with local nurseries to provide native, genetically similar shrub species for restoration purposes.<br>- On ultramafic soils areas which have an excess of small to mid-sized shrubs and trees, burn to decrease these vegetation types and to decrease the dead and accumulated duff. Burn in pockets or strips to create a mosaic pattern.<br>- Maintain or increase large woody material to meet management recommendations for survey and manage bryophytes, lichens and fungi.<br>- Maintain adequate canopy cover in forested habitats to meet management recommendations for survey and manage vascular plants, bryophytes, lichens and fungi.<br>- Maintain openings in forested habitats to benefit California globe mallow, wayside aster, and McDonald's rockcress.<br>- Special Forest Products: Identify key habitats and possible conflicts with rare plants, minimize impacts to these areas.<br>- Avoid burning known sites of sensitive plants during prescribed or natural fire. Burn around population areas under very controlled, experimental conditions. Monitor results.<br>- Research and develop effective restoration strategies for past mining areas, especially where tailings are present, where it is necessary to re-vegetate these areas.<br>- In places such as the French Flat ACEC stop recreational vehicle trespassing.<br>- Pursue an evaluation of the RNA / ACEC designation potential for those cells identified in the analysis. |

# V. ANALYSIS OF KEY QUESTIONS

## A. Key Question T-1: Wildlife and Wildlife Habitats

*T-1: What are the existing conditions, what were the historical conditions, what are the trends, and what is the desired future condition for:*

*- the relative abundance and distribution of wildlife species of concern in the watershed (i.e., threatened or endangered species, special status species, species emphasized in other plans).*

*- the distribution and abundance of their habitats.*

*- the processes that affect these species and their habitats?*

More than 200 vertebrate and thousands of invertebrate wildlife species may live in the East Fork of the Illinois River watershed. Of these, the species of concern are:

1) Species federally listed as "proposed, endangered or threatened" by the Endangered Species Act;

2) Species listed as Sensitive by Region 6 or Region 5 of the USDA Forest Service; and

3) Species identified as "survey and manage", "protection buffer", "needing more analysis," State listed, or ``management indicator" species by the Siskiyou National Forest Land and Resource Management Plan (LRMP) or the Medford District Resource Management Plan (RMP). See Appendix A - Wildlife for more detailed species of concern information.

Although knowledge about the distribution and abundance of species of concern and locations of individuals are important for managing species, relatively little is known about most animals (See Appendix A). Except for a handful of the "ESA listed" species, almost nothing is known about wildlife distribution and abundance in this watershed. Systematic surveys for a few species have been primarily conducted in project areas. Data about other species comes primarily from incidental sightings. Location information is important for maintaining wildlife that are threatened with extinction, such as northern spotted owls, because human activities that may have negative impacts on nesting success can be avoided during breeding season. Northern spotted owls are known to nest in the watershed.

Location information is important to management activities near some species; however, habitat management has the greatest effect on all species. If adequate habitats for species of concern are not present in the watershed, these species will not be there. Conversely, if habitat conditions are present a species of concern could occur in the watershed.

Assessing habitat adequacy depends on identifying appropriate habitat elements to measure and evaluate, and then determining the distribution (where) and abundance (how much) of these elements that are necessary for meeting the wildlife needs. Although neither the appropriate habitat elements nor the distribution and abundance is known for all the species of concern, a considerable amount is known. Wildlife research has identified a host of habitat elements that wildlife need, and analysis can shed light on the distribution and abundance of these elements in the watershed.

### 1. Habitat Elements

Habitat associations for wildlife species of concern in the East Fork of the Illinois River watershed were identified using information from Management of Fish and Wildlife Habitats of Western Oregon and Washington (Brown et. al. 1985) and the LRMP and RMP. Species of concern are associated with a wide range of habitat elements: grass/forb, shrub, seedling/sapling/pole, young forest, mature forest, old growth forest, caves & burrows, cliffs & rims, large down wood, snags, talus, and riparian/aquatic (Appendix A, Tables T-A-2).

Habitats with the most species of concern using them as primary habitat are:

- Old-growth forest (20 species)
- Interior mature and old-growth forest, as well as large (>32" dbh) trees with deformities (e.g., cavities, witch's brooms, and large limbs) are also identified as important wildlife habitat characteristics by the NW Forest Plan (see Appendix A, Table T-A-3).
- Snags (20 species)
- Riparian/aquatic (19 species)
- Mature forest (13 species)
- Large down wood (13 species)

Maintaining an appropriate distribution and abundance of these habitats is part of the purpose of the NW Forest Plan.

The LRMP and RMP's standards and guidelines focus heavily on the habitat elements listed above. The plans determined that the viability of many mature and old-growth and aquatic species is not at risk if the plan is followed. These plans also identify many species whose viability are in question and need more analysis. This forms the basis for the S&M species.

The aim of the wildlife portion of this watershed analysis is to make recommendations that will maintain and / or restore wildlife habitat elements to levels within their reference / historic range of variability.

### 2. Disturbance

Disturbance, especially fire, has changed the distribution and abundance of habitat elements for millennia, and species are adapted to this natural range of variability. In fact, some species require disturbance. For example, pine and Douglas-fir trees historically reached large size because periodic low intensity fires removed competing vegetation.

To provide for the needs of wildlife species of concern, the range of conditions they are adapted to should be sustained. Species are the result of their past adaptations, and their survival can only be assured if the conditions they are adapted to are maintained.

In order to make a first approximation of the natural range of habitat variability, this watershed analysis focuses on attempting to understand how much habitat components have changed. Disturbance and site productivity influence these habitat elements. Site productivity is influenced heavily by climate and geology. Climate (especially available moisture) and geology (soil parent material) have the greatest influence on a site's ability to produce these habitat elements. Good soil and high moisture availability combine to produce abundant vegetation which produces many animals. Forest types were stratified into plant series that reflect how weather and soil parent material effect site productivity and how fire disturbance effects each plant series (Atzet and Wheeler 1984).

The species of concern identified in this document are not generally identified as being associated with a particular plant series but certain plant series can provide important habitats for certain of these species. Conversely, some plant series can be identified that will not support certain species of concern. For example, the Jeffery pine plant series (found on serpentine) does not normally produce the large sized trees (>32" dbh) or the canopy closure (>40%) necessary for old growth forest habitat, but it does provide conditions that are suitable for many rare plants. There are approximately 5,200 acres (14%) of low productivity serpentine soils on Forest Service and approximately 1,400 acres on BLM lands in the watershed. Except for shrub and other understory development, these serpentine areas have not changed dramatically since around 1940. Generally, serpentine does not support closed canopy old growth forest wildlife habitat, primarily because canopy closures greater than 40% are rare and old growth sized trees (>32" dbh) generally cannot develop. Therefore, serpentine areas were not considered when modeling historic (circa 1940) conditions on National Forest lands because it is assumed that current forest conditions on serpentine are generally similar to reference conditions.

Maintaining the range of variability for important habitat elements is dependent upon maintaining the effects of disturbance similar to the effects of past disturbances. It is recommended that while the extremes of the range of variability be maintained, management should primarily focus on conditions in the middle portion of the range of variability for any given habitat element (Atzet, personal communication, 1999). For example, managing late-successional (mature and old-growth) forest at the lower end of the natural range of variability may benefit some resources, such as short-term timber production and deer forage, but this could also put long-term productivity of these resources at risk, and reduce the resilience of ecosystems. Analysis cannot completely identify ranges, but approximations can be made. Future modification of these "approximations" is expected as better information is obtained. It is acknowledged that when recommending appropriate ranges that many extreme fluctuations of distribution and abundance of habitat elements are responses to factors outside human control. These factors, such as climate change and severe fire weather conditions, will happen regardless of our efforts.

Table T-2 provides a first approximation of reference conditions for wildlife habitat components on non-Serpentine areas in the watershed. This was created using information from East Fork of the Illinois River and other ecosystem analyses which covered over 300,000 acres on Galice and Illinois Valley Ranger Districts. (For details about modeling assumptions used to derive reference conditions see Appendix A, Table MA, Modeling Assumptions for PMR data).

The amounts of habitat components listed in Table T-2 generally represent what is thought to be an average of the historic range of variability at a time (circa 1940) before timber harvesting and fire exclusion changed conditions. Actual historic ranges are unknown

Table T-2: First Approximation of Reference Conditions for Wildlife Habitat Components on Non-Serpentine Areas

| Habitat Components | Reference Condition (average/range)* |
|---|---|
| Cliffs, Rock outcrops, Caves, Adits, and Talus | Maintain as undisturbed areas |
| Grass/Forb openings and forest under-story | Grass / Forb: 2% of the watershed<br>Understory: undetermined. |
| Seed/Sap/Pole<br>(FS: <9"dbh - USFS<br>BLM: < 11" dbh) | Maintain 20% of area in forage for deer and elk (Siskiyou LRMP) and 180 other associated species (Brown 1985). Much of this 20% would be from seed-sap-pole; however, meadows and under-burned mature and old-growth would also contribute if over-story canopy closure is reduced and/or canopy gaps are present. |
| Young forest (Small conifer and hardwood) (FS: 9 -21"dbh; BLM: 11-21") | 20% |
| Late-Successional<br>(BLM: >21" dbh)<br>(FS: Mature (21-32" dbh) and Old Growth (>32"dbh) conifer and hardwood) | 45-75% of landscape with 75% in LSRs (USDA/USDI 1995:36) and in Riparian Reserves; at the stand scale, 8-16 mature trees, 8-16 old growth trees per acre and numerous hardwoods (Bingham and Sawyer 1991). Canopy closure (based upon 1940 aerial photo analysis) should average approximately 50%. |
| Old Growth (>32"dbh). Data from Stair Creek, East Fork Illinois River, Althouse Creek, and Sucker Creek (non-serpentine). | 40% of watershed in late-successional forest. Canopy closure (based upon 1940 aerial photo analysis) should average approximately 50%. |
| Old Growth (>32"dbh) in Riparian Reserves (class 1-3 streams) Stair Creek, East Fork Illinois River, Althouse Creek, and Sucker Creek. | FS: 45% of Riparian Reserves had old growth forest. Canopy closure (based upon 1940 aerial photo analysis) was approximately 50%.<br>BLM: Data gap. |
| Interior Mature and Old Growth (non-serpentine) conifer and hardwood (19% Althouse, 25% Caves & Grayback, 35% Indigo, and Stair 49% ) | 25-35% |
| Dead Wood: Large Woody Material and Snags | Reference condition is a DATA GAP. As a starting point, use Standards and Guidelines from amended Siskiyou Forest Plan as described in "Guidelines for Harvest Prescriptions; Large Woody Material, Green Tree Retention, [and] Wildlife Reserve (Snag) Tree Retention Guidelines (USDA Forest Service, 14 Nov. 1996) or, where appropriate, "A Field Guide to the Tanoak and the Douglas-fir Plant Associations in Northwestern California" (Jimerson 1996). These guides are based on existing condition data, collected from un-managed stands; therefore represent conditions modified by decades of fire exclusion. Specific existing condition data for East Fork Illinois watershed is a DATA GAP. |
| Pine/Oak Savanna (pines and oaks provide food for more animal spp. than any other plants (Martin et al.1951) | Restore as much as possible. |

* Reference condition may be a desired condition, but not for all situations. For example, reference condition for canopy closure in mature and old growth forests (in uplands and Riparian Reserves) is 50% in East Fork of the Illinois on National Forest lands; this canopy closure may not be desired by perennial streams until more of the stream-side shade is recovered in the watershed. Also, research indicates some species are associated with higher than 50% canopy closure in mature and old growth forest habitat; e.g., Del Norte salamander. However, this research was conducted in habitats affected by decades of fire exclusion and consequently, in habitats with increased canopy closures. Reference condition may also not be the desired condition identified and selected through the agencies' resource planning processes (RMP, LRMP).

Tables T-3a and T-3b describe the current and reference conditions of wildlife habitat components in the watershed on National Forest System (Tables T-3a) and then BLM (Tables T-3b) lands.

Table T-3a: Habitat Components on Non-Serpentine areas in East Fork of the Illinois River Watershed on National Forest Lands

| Habitat Components on National Forest lands | Current Condition East Fork of the Illinois River | Reference Condition ** East Fork of the Illinois River |
|---|---|---|
| | PMR Pixel Data | Modeled PMR Pixel Data To Pre-Harvest Condition |
| Non-Forest | Steady state or declining due to encroachment | Steady state |
| Grass/Forb | 76 ac. or <1 % | DATA GAP |
| Shrub Dominated | 2199 ac. or 7 % | |
| Seed/sap/pole (<9"dbh) | 9,519 ac. or 30% | 4,192 ac. or 13% |
| Young Forest (11-21" dbh) | 3,256 ac. or 10% | 2,622 ac. or 8% |
| Mature Forest (21-32" dbh) | 8,273 ac. or 26% | 7,862 ac. or 25% |
| Old Growth (> 32" dbh) | 6,026 ac. or 19% | 13,166 ac. or 42% |
| Interior Older Forest (Analysis considered Mature and Old Growth patches larger than 20 ac.) | 3,200 ac. or 10%<br><br>This habitat is in twenty-nine patches, with six larger than 100 acres and the largest 747 acres. The majority of these patches are relatively isolated / disconnected. | 9,371 ac. or 30%<br><br>This habitat was in 24 patches, with ten patches larger than 100 acres, and the largest 4,447 acres. Over 70% were in four relatively connected patches that joined most of the WAA's on the eastern portion of the watershed (Dunn, Elder, & Little Elder areas). |
| Cliffs, Rock outcrops, Caves, and Talus | Sometimes impacted by rock pit and road development. Also impacted by timber harvest effects on microclimate, esp. on talus. Fire suppression has increased stand densities, therefore may have increased humidity on talus microclimate. | Were essentially undisturbed except for some fire impacts. |
| Dead Wood: Large Woody Material and Snags | Reduced amounts of high concentrations of class 1 & 2 pieces of dead wood due to fire suppression, fire salvage, and timber harvest. The landscape may have more background levels of dead wood over the watershed due to fire exclusion preventing consumption by frequent fires, especially older (class 3+) down wood. | Historic conditions are unknown. Reference conditions were established using Eco-plot data and used to establish direction for the Siskiyou National Forest for different plant series' in Guidelines for Harvest Prescriptions; Large Woody Material, Green Tree Retention, [and] Wildlife Reserve (Snag) Tree Retention (14 Nov. 1996). |
| Pine/Oak Savanna | Most of the areas with pine/oak savannas are nearly gone, due to heavy encroachment by Douglas-fir and other vegetation. Many pines, especially the big ones, are dead or dying. Some large black oaks and white oaks remain. Encroachment and mortality will continue unless stand densities are decreased. | Historically, this habitat was common at lower elevations in the watershed. This habitat is maintained by frequent natural, and many human caused fires (Borgias 1997 (see Social Module discussion of burning by Native Americans). |

** For details about modeling assumptions used to derive reference conditions see Appendix A, Table MA, Modeling Assumptions for PMR data.

Table T-3b: Vegetation Condition on Non-Serpentine Areas in East Fork of the Illinois River Watershed on BLM Land

| | Current Condition; East Fork of the Illinois River | Reference Condition: East Fork of the Illinois River (1949 Timber Inventory for Josephine County) |
|---|---|---|
| Non-Forest/Non-Vegetated | 94 ac / 2% | 115 ac. or 3% |
| Grass/Forb | 0 ac / 0% | 31 ac. or 1% |
| Shrub Dominated | 3 ac / <1% | DATA GAP |
| Seed/sap/pole (<11"dbh) | 508 ac / 10% | 1,692 ac. or 44% |
| Young Forest (11-21" dbh) | 1067 ac / 21% | 329 ac. or 9% |
| Mature Forest (21-32" dbh) | 2004 ac / 40% | 1,676 ac. or 44% |
| Old Growth (> 32" dbh) | DATA GAP | |

Table T-3c: Vegetation Condition on Serpentine Areas in East Fork of the Illinois River Watershed on BLM Land

| | Current Condition; East Fork of the Illinois River | Reference Condition: East Fork of the Illinois River (1949 Timber Inventory for Josephine County) |
|---|---|---|
| Non-Forest | 0ac / 0% | DATA GAP |
| Grass/Forb | 456 ac / 9% | DATA GAP |
| Shrub Dominated | 109 ac / 2% | DATA GAP |
| Seed/sap/pole (<11"dbh) | 32 ac / <1% | DATA GAP |
| Young Forest (11-21" dbh) | 269 ac / 5% | DATA GAP |
| Mature Forest (21-32" dbh) | 470 ac / 9% | DATA GAP |
| Old Growth (> 32" dbh) | DATA GAP | |

Tables T-3b and 3c show current and reference (circa 1950) conditions on BLM lands. The recent era of timber harvest on BLM lands started after this point in time. However, impacts from previous mining (1850-early 1900's) and associated logging were intense in and around the valley floor and are reflected in the 1950 reference condition data. The condition of BLM lands before significant modifications from mining is not known. There are some areas identified that were particularly heavily impacted by mining and where forest retention after mining activities is unlikely. These areas are:

*Allen Gulch (40-8-34)*: Approximately 80 acres of Allen Gulch has forest vegetation growing on placer mine debris. This land is located in the southwest 1/4 of the northeast 1/4 (approx. 15 acres), the southeast 1/4 of the northwest 1/4 (approx. 25 acres), the northeast 1/4 of the southwest 1/4 (approx. 30 acres), the northwest 1/4 of the southeast 1/4 (Shenon 1933). Smaller diameter trees occur just downhill from the Allen Gulch cemetery indicating more intense or more recent disturbance. Below that, the trees are larger and demonstrate the ability of closed canopy forest vegetation to re-establish itself even after severe disturbance. Second-growth timber including trees 50 to 60 years old covered most of the mined ground in Allen, Sailor, and other gulches, and fixes rather definitely the time elapsed since that mining period (Shenon 1933). This would approximate the end of the mining at around 1878.

*Scotch Gulch (40-8-33 and 41-8-3)*: Sluice boxes were used to separate the gold from rocks and dirt. One of these, operated in Scotch Gulch in the 1870s was said to have employed as many as 50 men, shoveling, piling rocks, etc. (Street and Street 1973).

*Esterly Mine (40-8-22):* The most extensive mining was done by the hydraulic method. If you can imagine a two to six inch diameter nozzle with perhaps one hundred to one hundred fifty pounds per inch water pressure you will have some idea of the amount of power such a thing would have. With this, large boulders and tree stumps can be rolled out of the way, high banks undermined and caved and an immense amount of dirt washed through a sluice in a day. The Easterly mine is said to have handled five hundred to one thousand cubic yards of dirt per day by this method (Street and Street 1973).

For more information, see Map 14, (East Fork Watershed Analysis Historic Interior, Mature and Old Growth Forest) Map 13,(East Fork Watershed Analysis Current Interior, Mature and Old Growth Forest)

Tables T-4a and T-4b describe the current and reference conditions of wildlife habitat components in the riparian reserve areas on National Forest System (Tables T-4a) and then BLM (Tables T-4b) lands.

Table T-4a: Habitat Components (Forest Size/Structure) on Non-Serpentine in Riparian Reserves on National Forest Lands

| Habitat Components | Riparian Reserves: Current Condition (PMR); East Fork of the Illinois River. (% figures below are % of total Stream Class Acres) | | | Riparian Reserves: Reference Condition (PMR) ** East Fork of the Illinois River. (% figures below are % of Stream Class Acres) Canopy closure of Mature and Old Growth in 1940 averaged about 50 % on National Forest | | |
|---|---|---|---|---|---|---|
| | Class 1&2; 3,661 ac. | Class 1,2,&3; 7,656 ac. | Classes 1,2,3,&4; 13,141 ac. | Class 1&2; 3,661 ac. | Class 1,2,&3; 7,656 ac. | Classes 1,2,3,&4; 13,141 ac. |
| Grass / Forb<br>Shrub Dominated | DATA GAP | DATA GAP | DATA GAP | DATA GAP | DATA GAP | DATA GAP |
| Seed/sap/pole | 1,455 ac. 40% | 2,982 ac. 39% | 5,129 ac. 39% | 986 ac. 27% | 1,918 ac. 25% | 3,224 ac. 25% |
| Young Forest (9-21" dbh) | 357 ac. 10% | 759 ac. 10% | 1,360 ac. 10% | 293 ac. 8% | 615 ac. 8% | 1,075 ac. 8% |
| Mature Forest (21-32" dbh) | 934 ac. 26% | 1,958 ac. 26% | 3,215 ac. 24% | 881 ac. 12% | 1,859 ac. 24% | 3,045 ac. 23% |
| Old Growth (> 32" dbh) | 728 ac. 20% | 1,445 ac. 19% | 2,402 ac. 18% | 1,358 ac. 37% | 2,874 ac. 38% | 4,979 ac. 38% |

** For modeling assumptions used to derive reference conditions see Appendix A: Table MA, Modeling Assumptions for 1950 timber inventory data.

| Table T-4b: Habitat Components (Forest Size/Structure) on Non-Serpentine in Riparian Reserves on BLM Administered Lands. | | |
|---|---|---|
| Habitat Components, BLM | Riparian Reserves<br>Current Condition<br>East Fork of the Illinois River<br>(% figures below are % total | Riparian Reserves:<br>Reference Condition<br>(1950 Timber Inventory):<br>East Fork of the Illinois River.<br>(% figures below are % of total) |
| | Fish bearing and 2+ order streams<br>754 ac. | Fish bearing and 2+ order streams<br>608 ac. |
| Non - vegetated | 63 ac / 7% | DATA GAP |
| Grass/Forb | DATA GAP | DATA GAP |
| Shrub Dominated | | |
| Seed/sap/pole | 84 ac / 9% | 229 ac. or 38% |
| Young Forest<br>(11-21" dbh) | 163 ac / 18% | 78 ac. or 13% |
| Late-Successional Forest<br>(21+" dbh) | 444 ac / 50% | 261 ac. or 43% |

The following table, Table T-5, identifies the past and future trend for habitat components on the non-serpentine soils of the watershed. The future trends noted assume continued successful fire exclusion, which becomes less likely as more time passes and fuel loading increases, or assumes density reduction treatments are successful over the majority of the watershed on federally administered lands. If fire exclusion or density reduction is not successful at the watershed scale, an increase in the amount of intense fires (caused by fire in high density stands) is likely.

| Table T-5: Trends for Habitat Components on Non-Serpentine Soils (National Forest and BLM) | | |
|---|---|---|
| Habitat Components | Trend: Past 100 Years | Trend: Future 100 years |
| Grass/Forb | Large grass/forb areas lost to tree encroachment in meadows and mature and old growth forest areas. Until the past five to ten years, fall burning of clear-cuts created good conditions for grasses and forbs. Cooler spring burns of the recent past do not create favorable conditions for this habitat element. | Same as past 100 years except some meadows will be restored. |
| Shrub Dominated | Shrub dominated areas reduced by tree encroachment caused by fire exclusion. | Trend will continue. |
| Pole/Sapling | Amount of pole/sapling acres increased by regeneration timber harvest, fire exclusion, and mining (primarily in lowlands). | Decreased from past trend as and timber harvest levels are reduced and these tree sizes grow into larger size classes. Amounts will decrease, but distribution may not be natural due to the distribution of the Matrix land allocation and private land. |
| Young Forest<br>(FS: 9-21" dbh; BLM: 11-21") | Amount of young forest increased by timber harvest, fire exclusion, and mining (primarily in lowlands). | |

| Table T-5: Trends for Habitat Components on Non-Serpentine Soils (National Forest and BLM) | | |
|---|---|---|
| Habitat Components | Trend: Past 100 Years | Trend: Future 100 years |
| Mature Forest (21-32" dbh) | Amount decreased by mining and timber harvest, and increased as young forest grew into larger trees with successful fire exclusion. Increased amount of fire intolerant vegetation and canopy closure in natural stands. Canopy closures increased from about 45-55% historically (1940 aerial photo analysis) to current canopy closures that are currently much higher. | Amount of mature and old growth, and interior mature and old growth forest habitat on National Forest Lands and in riparian reserves on all federal land should increase over the next 50-100 years as smaller trees grow into these larger size classes. Amounts could increase but distribution may not be similar to historic conditions due to distribution of LSRs, other land allocations, and private land. Matrix lands will generally not have forest >32" Dbh reflective of the objectives for the allocation. |
| Old Growth Forest (> 32" dbh) | On National Forest, approximately 50% of old growth forest was clear-cut, compared to pre-harvest condition. Fire intolerant vegetation and canopy closure has increased in natural/unmanaged stands. Canopy closures increased from about 45-55% historically (1940 aerial photo analysis) to levels that are currently much higher. Data gap on BLM. | |
| Interior Mature and Old-Growth (400 ft. edge effect) | Harvest strategies have generally maximized fragmentation by dispersing harvest over the landscape and harvesting relatively small areas *(i.e.* less than 60 acres) compared to pre-harvest conditions. | |
| Cliffs, Rock outcrops, Caves, Adits, and Talus | Rock pit and road development peaked in the 1970's and 1980's and has declined in the 90's, so impacts to cliffs and talus have also declined. Also impacted by timber harvest effects on microclimate, esp. on talus. Fire exclusion has increased stand densities, therefore increased humidity on talus microclimate. | Microclimate humidity will recover in areas disturbed by roading or harvest. Some rock pits may remain open. Humidity will increase as forest stands grow and canopy closure increases, until fire or other density reducing disturbances occur.<br>Renewed mining efforts, and collapse could cause a decline in the amount of adits. |
| Dead Wood: Large Woody Material and Snags | *Unmanaged stands:* increase in how long dead wood lasts, due to fire exclusion. Decrease of area with high densities of dead wood due to fire exclusion, fire salvage, and timber harvest.<br>*Managed Stands*: Most timber harvest areas are below desired levels, especially for snags. Early timber cutting left more down wood than cutting over most of the past 30 years has; recent harvest (last five years) left more. | Increased amounts, as high stand densities cause mortality of trees (including large sizes) or more is left following timber harvest in Matrix or density reduction in other land allocations. Riparian Reserves will eventually have late-successional component of both snags and down wood. |
| Pine/Oak Savanna | Most of the areas with pine/oak savannas have been converted to farmland or housing developments, or heavily encroached by Douglas-fir and other trees. Most pines are dead or dying. Some large black oaks and white oaks remain among encroachment, but mortality will continue unless encroachment is reduced or eliminated. | Without active restoration efforts this habitat type will continue to disappear. |

Table T-6 compares the amounts of current and reference conditions for different habitat components on non-serpentine sites on National Forest land in the watershed. These numbers represent what is thought to be the middle of the range of variability. The actual historic range is unknown.

Habitat conditions of BLM lands before significant modifications from mining are not known. Although BLM lands in the watershed were no doubt quite different from National Forest lands, such as more pine/oak savanna and more historic impacts from Native Americans, perhaps using the reference conditions described for National Forest lands is a reasonable “first approximation” of reference conditions on some of the BLM lands. For example, the reference conditions of mature and old-growth forest on National Forest land is 67%, but on BLM it is only 44%.

Table T-6: Key Findings: Comparison of Current and Reference Habitat Components for Non-Serpentine Areas on National Forest Land

| Habitat Components, National Forest System lands | Current Condition | Reference Condition | Difference between current and Reference Conditions |
|---|---|---|---|
| | **Percentages represent the percent of National Forest lands** | | |
| Grass/Forb | Much less than the past<br>DATA GAP | Meadows & brush-fields restored and grass/forb & shrub abundance increased in forested habitats:<br>DATA GAP | DATA GAP |
| Shrub Dominated | | | |
| Pole/Sapling | 9,519 ac. or 30% | 4,192 ac. or 13% | -5,327 ac. or -17% |
| Young Forest | 3,256 ac. or 10% | 2,622 ac. or 8% | -634 ac. or -2% |
| Mature Forest - 21-32' dbh -(8-16 mature trees per acre) | 8,273 ac. or 26%<br>(18% of mature is in Matrix) | 7,862 ac. or 25 % | -411 ac. or -1% |
| Old Growth - >32" dbh - (8-16 old growth sized trees per acre) | 6,026 ac. or 19%<br>(21% of OG is in Matrix) | 13,166 ac. or 42% | 7,140 ac. or 23% |
| Interior Mature and Old-Growth | 3,200 ac. or 10%<br>The majority of these patches are relatively isolated/disconnected. | 9371 ac. or 30%<br>The vast majority - over 70% - were in four relatively connected patches that joined most of the WAA's on the eastern portion (Dunn, Elder, & Little Elder areas) of the watershed. | 6,171 ac. or 20%<br>Restoration is a function of location; *i.e.*, proximity to exiting interior habitat. The total amount of acres that need treated could be less or more than 20%. |
| Riparian Reserve, Grass/Shrub | DATA GAP | DATA GAP | DATA GAP |
| Riparian Reserve, Pole/Sapling | 5,129 ac or 39% of RR | 3,224 ac. 25% | -1,905 ac. or -14% |
| Riparian Reserve, Young Forest | 1,360 ac. or 10% | 1,075 ac. 8% | -285 ac. or -2% |
| Riparian Reserve, Mature Forest (21-32" dbh -(8-16 trees per acre) | 3,215 ac. or 24% | 3,045 ac. 23% | -170 ac. or -1% |
| Riparian Reserve, Old Growth - >32" dbh - (8-16 trees per acre) | 2,402 ac. or 18% | 4,979 ac. 38% | 2,577 ac. or 20% |
| Cliffs, Rock outcrops, Caves, and Talus | Developed rock pits and reduction of micro-climate by timber harvest have degraded habitat quality | Minimize disturbance of sites. | DATA GAP |
| Dead Wood: Large Woody Material and Snags | Below reference condition in many managed stands | See Siskiyou Guidelines or "A Field Guide to the Tanoak and the Douglas-fir Plant Associations in Northwestern California" (Jimerson 1996). | Meet Siskiyou Guidelines or "A Field Guide to the Tanoak and the Douglas-fir Plant Associations in Northwestern California" (Jimerson 1996). |
| Pine/Oak Savanna | Heavily encroached by undesirable trees and brush | Healthy pines and deciduous oaks with grass/forb under-story | All places where this habitat occurs |

Table T-7 outlines management recommendations that could be used to maintain or restore wildlife habitat components to the reference / historic condition on federal lands.

Table T-7: Management Recommendations for Maintaining and Restoring Wildlife Habitat Components for Federal Lands.

| Habitat Component | Recommendations |
|---|---|
| Grass/Forb | - Under-burn young, mature, and old growth forests, as well as pine/oak savannas.<br>- Burn regeneration harvest units hot enough to provide a seed bed for grasses and forbs.<br>- Remove encroaching vegetation from meadows with manual, mechanical, and/or prescribed fire treatments. Maintain meadows with prescribed fire.<br>- Use native species when seeding disturbed areas.<br>- A number of meadow restoration opportunities exist. See Map 25: Special Wildlife Areas - National Forest Lands. See Map 9A (Plant Series on BLM) and those lands where all Jeffrey pine, ponderosa pine, and white oak sites, as shown on the plant series map, are candidates for meadow restoration. |
| Shrub Dominated | - Use prescribed fire, manual, or mechanical treatments in openings and under-story of forest habitats. |
| Seed/Sap/Pole | - Use timber harvest (regeneration or widely spaced thinning) and prescribed and natural fire to create this habitat consistent with land allocation objectives.<br><br>- Extend the time which seed-sap-pole habitat provides grass, forb, and shrub habitat for 180 associated species (Brown et al. 1985) with treatments like manual release and pre-commercial thinning.<br><br>- Priority areas are winter range (i.e., south aspects with < 40% slope and < 3000 feet elevation). |
| Young Forest (9/11-21" dbh) | - Increase diameter growth of young forest trees to restore old growth forest habitat consistent with land allocation and management objectives.<br>- Maintain hardwoods, especially shade-intolerant species.<br><br>- Reduce fire hazard to this habitat by reducing: ground and under-story fuels, fuel ladders, and the density of over-story crown; and increasing the distance to over-story crown to reduce crown fire potential (Agee 1997).<br>- Priority areas are:<br>a) Upland portions of Riparian Reserves and adjacent to intermittent and ephemeral streams;<br>b) Sites adjacent to<br>- Roads (for use as control points and to improve economic feasibility),<br>- Wilderness areas,<br>- Private land (rural interface),<br>- Sites within or adjacent to connections between interior mature and old growth habitat (especially those at lower elevations or occupied by nesting spotted owls).<br><br>- Excellent opportunities to treat young forest habitat exist in Elder, Little Elder, Page, Chapman, and portions of Dunn Creek drainages within both managed and unmanaged stands. |

| Table T-7: Management Recommendations for Maintaining and Restoring Wildlife Habitat Components for Federal Lands. | |
|---|---|
| Habitat Component | Recommendations |
| Mature Forest (21-32" dbh)<br><br>Old Growth Forest (>32" dbh)<br><br>Interior Mature and Old Growth, patches > 20 ac. in size (400ft. edge effect). | *National Forest Lands*:<br>- Increase the overall abundance of old growth forest habitat in the watershed, especially trees > 45" dbh. *<br>- At the watershed scale, manage such that 45-75% of the area is in mature and old growth forest habitat (40% of which should be old-growth on National Forest<br>- In Riparian Reserves, manage such that 50-80% of the area is in mature and old growth forest habitat<br>- At the stand scale, manage to provide 8-16 mature conifers per acre, 8-16 old-growth trees per acre, and an appropriate amount of hardwoods (Bingham and Sawyer 1991), amount of trees > 45" dbh per acre is a DATA GAP. A significant percentage of the large trees should have defect or deformities such as cavities, large limbs, and witch's brooms (from mistletoe).<br><br>*BLM lands:*<br>- In riparian reserves actively manage for an approximate distribution 70% late-seral, 15% mid-seral, and 15% early-seral. Active management will be critical as this level of late-seral forest is greater than the historic / reference level.<br><br>- Increase the size of interior mature and old growth forest patches and the connectivity between patches.<br>- Thinning and/or prescribed fire should, in the short term, help to maintain mature and old growth habitat conditions; and in the long term hasten restoration of mature and old-growth habitat (Agee 1997).<br>- Priority locations for restoration are adjacent to or connections between interior mature and old-growth forest and within Riparian or Late-Successional Reserves. For the long term, priority locations for restoration of old growth are within Riparian or Late-Successional Reserves. Maintaining mature forest in Matrix may be consistent with timber management objectives, but maintaining old growth habitat may not be; therefore, old growth habitat is less likely to be restored in Matrix.<br>- Reduce fire hazard to mature and old growth forest habitat. Priority areas are where the fire hazard is moderate or high within interior mature and old growth habitat patches (especially the largest patches), and in Riparian and Late-Successional Reserves. The location of interior habitat patches with moderate or high fire hazard is a DATA GAP. However, the location of young, mature, and old growth habitat that has moderate fire hazard is shown on Maps 21A and 21B: Fire Hazard Levels / Rating. Treatments could include manual, mechanical, or prescribed fire, or let wildfire burn when conditions are appropriate. (**See Note below**) |
| Cliffs, Rock outcrops, Caves, Adits, and Talus | - Maintain the majority as undisturbed areas; |
| Dead Wood: Large Woody Material and Snags | - Meet Siskiyou National Forest Guidelines (USDA Forest Service 1996) or, where appropriate, use "A Field Guide to the Tanoak and the Douglas-fir Plant Associations in Northwestern California" (Jimerson 1996) or use "Snag Densities on the Gasquet Ranger District, Six Rivers National Forest, California" (Jimerson 1989). Specific data for East Fork Illinois watershed is a DATA GAP. |
| Pine/Oak Savanna | - Reduce encroachment. Maintain savannas, after removing encroachment, by burning as frequently as needed (about every 5 years).<br>- Priority locations are anywhere this habitat is found. This habitat is more common in the lower elevations on BLM lands, primarily on the west side of the watershed and lower portions of Chapman Creek. On National Forest, it is most often found on foothills adjacent to the valley bottom; e.g., lower Page Creek and some south aspects near lower Dunn Creek. |

***** ***Note:*** With density reduction in young and mature forest stands, it may be possible to restore old growth forest habitat, as described by Bingham and Sawyer (1991), to desired levels within 30 to 40 years (see Figure T-1, "Years To Reach Mature Or Old Growth Forest Habitat" and Table T-18, "Density Treatment Scenarios"). Care must be taken during density reduction treatments to ensure all old growth characteristics are retained or restored. These characteristics include the appropriate levels of dead wood and a significant percentage of the large trees should have defect or deformities such as cavities, large limbs, and witch's brooms (from mistletoe) (NW Forest Plan). ***Without density treatments, old growth forest is not likely to be restored to desired levels in the watershed, due to the probability of intense stand-replacing wildfires*** (Atzet, personal communications, 2000). Fire exclusion has caused a shift in the fire-regime from primarily low-intensity but frequent fires, to a regime that it has more high-intensity but less frequent fires. Frequent low-intensity fires reduced tree densities in mature and old growth forest and facilitated large diameter, while high-intensity but less frequent fires eliminate mature and old growth forest habitat; e.g., the Longwood Fire in 1987. This shift in fire regime will probably prevent attainment of the desired levels of old growth forest habitat in the watershed. Density reduction could set the stage for restoring the historic low-intensity fire regime and significantly reduce the future need for: mechanical treatments in Late-Successional and Riparian Reserves, and roads in Late-Successional Reserves.

## B. Key Question T-2: Fire and Fire Effects

*T-2. Where and how has fire affected the watershed, and where and how could fire affect the watershed in the future?*

### 1. Historic Wildfire Effects

Frequent fires characterized the Klamath Mountains Province. Prior to fire exclusion policies, wildfires occurred at least every 10 to 30 years in most forested areas of the watershed. American Indians were known to use fire to manipulate the vegetation for basket materials, and to maintain acorn production areas, wildlife habitat, hunting, and travel access. Early Euro-American settlers and miners were also reported to use fire to clear land for mining, grazing or farming. Natural ignitions from lightning are still a regular occurrence in the watershed today.

Limited wildfire suppression began with the creation of the Siskiyou National Forest in 1906. The Page Creek Guard Station was built near Takilma in 1909. A smoke jumper base also operated in the Illinois Valley from the 1940's until 1979. Siskiyou National Forest records indicate large fires occurred up to the 1940's (Table T-8), although at a lower number of acres burned than historic levels. Fire suppression efforts became very effective for the forest as a whole during the 1940's.

Table T-8: Number of Acres Burned on the Siskiyou National Forest, 1910-1998

| Decade | Acres Burned |
|---|---|
| 1910-1919 | 410,369 |
| 1920-1929 | 60,813 |
| 1930-1939 | 153,812 |
| 1940-1949 | 4,157 |
| 1950-1959 | 5,805 |
| 1960-1969 | 4,601 |
| 1970-1979 | 2,942 |
| 1980-1989 | 112,822 |
| 1990-1998 | 10,679 |
| **Total** | **766,000** |

Historically (before 1900), the fuel/vegetation profile was in a mosaic across the landscape. Skinner and Taylor (1998) found that a fire occurred about once every 5 years somewhere within their 5,000 acre Thompson Creek study area in northern California. These fires were often small in extent, but periodically (12 - 26 year interval) burned the entire study area. As a result, the vegetation/fuel profile was influenced by both the severity and the time since the last fire occurred. The landscape would have small to large areas with low fuel accumulations interspersed with areas with greater fuel concentrations. Fire spread in most low elevation, open stands would have been primarily through fine herbaceous fuels. These were surface fires where cured grasses, forbs and scattered shrubs, in addition to litter and dead-down stem-wood from an open shrub or timber over-story, contributed to fire intensity. Stands probably contained occasional concentrations of fuels that would generate higher intensities. In denser conifer or hardwood dominated stands, fire generally spread through light timber litter and dead-down stem-wood. These slow-burning ground fires had short flame lengths, although fires may have encountered an occasional "jackpot" or heavy fuel concentration where flame lengths increased *(i.e.*, flare up). Only under severe weather conditions involving high temperatures, low humidity, and high winds did these fuels pose significant fire hazards. Fuel accumulations would have been greater on more mesic sites where the fire-return interval was longer or where a past severe fire had killed many overstory trees.

In spite of fire suppression efforts, wildfires have continued to occur in the watershed (see Map 23: Fire History - National Forest Land). There have been 6 large fires (> 50 acres) on National Forest Lands in the watershed since 1940. Lightning caused all of these fires. The most recent were the 1987 lightning fires that involved over 8,000 acres in the East Fork Watershed. The largest was the Longwood Fire (9,916 acres including areas outside the watershed) near Takilma. The 1987 fires occurred in a below normal precipitation year, were late in the fire season (August into September), and resulted from multiple lightning caused ignitions. Dry weather conditions and multiple ignitions are common in the upper Illinois River.

Fire exclusion policies and timber management practices have changed the historic "frequent fire" regime in the watershed. Large fires have continued to occur, but suppression has lengthened the fire return interval. As the fire regime changed, the structure of the vegetation and fuels profile changed at both the stand and landscape scales. Under-story vegetation has increased, downed fuels have increased, continuity between under-story and over-story vegetation has increased (fuel ladders), and the vegetation / fuel profile is more uniform over the landscape. These conditions have created the potential for severe wildfires that can cause severe resource damage, and are difficult and expensive to suppress. See Appendix B, Fire and Plant Series for more detailed descriptions of the relationships between fire and vegetation.

The 1987 Longwood Fire is an example of the results of the changed fire regime in the watershed. Over 40% of the Longwood Fire burned with a high severity (e.g., stand replacement). When several fire events have been missed due to fire exclusion, the fires that do occur, are often more severe than those that historically occurred. Taylor and Skinner (1998) estimated historic fire severity in their Northern California study area was 59% low, 27% moderate, and 14% high.

Fires rarely escaped initial attack in the fire suppression era, except under severe fire weather conditions. This contributes to large fires burning under the most severe conditions. In the case of Longwood, the result is the single largest are of early-seral vegetation in the watershed.

Observations of the 1987 fires and the 1994 Dillon fire (Klamath National Forest) suggest that early-seral vegetation burned the most severely. Young conifer, hardwood stands, and brush fields, whether managed or unmanaged (natural), have densely distributed fine fuels (horizontally and vertically) and present a high hazard fire environment.

When wildfires such as Longwood occur, after the area has “skipped” many fire events, they are not "restored" to a historic fire regime. Increased fire severity in combination with dense stands can contribute to high fuel accumulations from fire-killed vegetation. Subsequent fires have the potential to remain severe until the vegetation and fuel profile is reduced to levels that are more historic.

Table T-9 summarizes average fire disturbance characteristics of the primary plant series in the watershed.

Table T-9: Average Fire Disturbance Characteristics By Plant Series

| Plant series | Average Stand Age | Average Interval (in years) | Estimated Interval Range |
|---|---|---|---|
| Douglas-fir | 230 | 15 | 10 - 60 |
| Jeffrey Pine | 282 | 14 | 10 - 80 |
| Ponderosa Pine* | DATA GAP | 15* | 5 - 25* |
| Port-Orford Cedar | 419 | 50 | 40 - 130 |
| Tanoak | 243 | 12 | 25 - 150 |
| White Fir | 213 | 25 | 10 - 60 |
| White Oak** | DATA GAP | DATA GAP | 5 - 10** |

Source: Forest Service Southwestern Oregon Ecology Plot Data and White et al., except where noted by an * or **.
*Ponderosa pine average interval is taken from Bork (1985) and Weaver (1959). Ponderosa pine estimated interval range is from Bork (1985) and Martin (1982).
**White oak estimated interval is from Agee (1990).

### 2. Hazard, Risk and Values at Risk

Wildland fire management considers the hazard, risk, and values at risk to identify the potential for wildfire to effect expected management outcomes in the watershed. Wildfire occurrence can prevent or delay achievement of land management goals and objectives. For example, stand destroying wildfire can prevent the development of mature and late-successional forest conditions as well as convert existing mature forests to early seral forests.

Hazard, risk and values at risk are defined as follows:

*Fire Hazard:* A fuel complex defined by volume, type, condition, arrangement, and location, which determine the ease of ignition and resistance to control. Resistance to control includes both fire behavior and suppression difficulty.

*Fire Risk:* The chance of a fire starting from all causative agents, including lightning.

*Values at Risk*: Any natural resources, improvements, or human values that may be lost due to fire.

The data collected for the watershed for hazard, risk, and values at risk for loss from wildfire are summarized in Tables T-9 through T-11. Ratings and other fire and fuels assessment information are displayed on Maps 19 through 24. Rating classification criteria are summarized in Appendix B.

| Table T-10: Fire Hazard | | | | | | |
|---|---|---|---|---|---|---|
| | HIGH | | MODERATE | | LOW | |
| | Acres | % | Acres | % | Acres | % |
| National Forest (Includes non-federal lands within NF boundary) | 6,393 | 18 | 22,356 | 61 | 7,838 | 21 |
| BLM | 2,549 | 50 | 2,355 | 47 | 139 | 3 |
| Non-Federal Lands | 7,347 | 46 | 7,849 | 49 | 757 | 5 |
| **Total** | 16,289 | 28 | 32,560 | 57 | 8,734 | 15 |

Only 15% of the watershed is in a LOW fire hazard condition. This is primarily due to fire exclusion policies and the resulting accumulation of fuels and increased vegetation density. Forest management practices that did not treat activity fuels have also contributed to this condition.

| Table T-11: Fire Risk | | | | | | |
|---|---|---|---|---|---|---|
| | HIGH | | MODERATE | | LOW | |
| | Acres | % | Acres | % | Acres | % |
| National Forest | 1,179 | 3 | 30,104 | 82 | 5,405 | 15 |
| BLM | 2,295 | 45 | 1,751 | 35 | 997 | 20 |
| Non-Federal Lands | 11,400 | 71 | 3,457 | 22 | 1,096 | 7 |
| **Total** | 14,874 | 26 | 35,312 | 61 | 7,498 | 13 |

Lightning, past human caused fires, and the current level of human use produces a medium to high level of risk for wildfire occurrence in the watershed.

| Table T-12: Values at Risk | | | | | | |
|---|---|---|---|---|---|---|
| | HIGH | | MODERATE | | LOW | |
| | Acres | % | Acres | % | Acres | % |
| National Forest | 31,283 | 85 | 0 | - | 5,405 | 15 |
| BLM | 1,295 | 26 | 2,505 | 50 | 1,243 | 24 |
| Non-Federal Lands | 10,161 | 64 | 1,696 | 11 | 4,096 | 25 |
| **Total** | 42,739 | 74 | 4,201 | 7 | 10,744 | 19 |

Values at risk are the resources and human values that may be lost due to wildfire in the watershed. Over 80% of the watershed has a moderate to high values at risk value. This is due to the amount of high value wildlife habitat, recreational values, and private property within the watershed.

A majority of the watershed (85%) is currently in a moderate to high fire hazard condition. Wildfires occurring on average worst fire condition days could exceed initial attack capability and have potential to become large stand replacement events. Takilma is an area of concern due to the high hazard, risk, and values at risk.

The Longwood Fire area is rated as mostly a moderate fire hazard within National Forest boundaries.

This rating should be a high due to the difficulty of suppressing a potential wildfire in the current post-wildfire fuel profile. Numerous snags, large continuous areas of untreated slash, and brush re-growth, make fire line construction difficult and fire fighter safety a concern.

3. Desired Future Condition For Wildfire Effects

Wildfires will continue to occur in the watershed. Desired future conditions for wildfire effects include:

- Reducing the number of acres burned by high severity wildfire;
- Reducing long-term fire suppression costs;
- Increasing firefighter and public safety;
- Protecting lives and property in the rural interface areas.

The potential for high severity wildfire can be reduced with implementation of fuel/vegetation treatments that reduce the fire hazard. Fire risk can be mitigated somewhat with fire prevention efforts, but all of the recent large fires in the watershed have been lightning caused. Reducing the fire hazard would also improve fire suppression effectiveness, firefighter safety, help protect rural interface areas around Takilma, and help protect and maintain wildlife habitats. Fuel/vegetation treatments should focus on reducing ground fuels, ladder fuels, continuous crown canopy closure, and favoring more fire tolerant tree species.

*A low fire hazard fuels profile should be predominant in the watershed, especially within rural interface areas, patches of interior forest habitat, and adjacent to the Siskiyou Wilderness*. In some situations, it may be advisable to implement manual, mechanical or other silvicultural treatments (commercial and non-commercial) alone or prior to the use of prescribed fire. Manual and mechanical treatments can reduce fuels loadings in high hazard or high value areas to permit future prescribed and prescribed natural fire use. Multiple entry / low intensity prescribed fire may also be utilized to gradually reduce fuel loadings to levels where future wildfire severity would be low. Some treatments may temporarily increase the fire hazard, but should provide a long-term hazard reduction benefit. Examples of potential fuel/vegetation treatments include: 1) Density management by commercial and pre-commercial thinning; 2) Fuel breaks along key ridge tops, adjacent to private lands, or other strategic locations; 3) Understory vegetation reduction by chipping, cutting, piling or underburning, 4) Fuel bed rearrangement by chipping, scattering, piling or underburning; and 5) Pruning to reduce ladder fuels.

4. Management Recommendations for fuels and fire include:

- Restore or maintain the historic fire regime where compatible with resource objectives.

- Develop a joint wilderness fire management plan for the Siskiyou Wilderness (Klamath, Siskiyou, and Six Rivers National Forests).

- Reduce fire hazard to the Siskiyou Wilderness; facilitate the use of prescribed natural fire in the Wilderness.

- Reduce fire hazard to the rural interface.

- Reduce fire hazard to interior mature and old growth forest habitat patches.

- Break up the fuels continuity in the moderate to high fire hazard areas within the Longwood Fire.

- Maintain a road system in the watershed that permits efficient wildfire suppression and economical fuel hazard reduction treatments.

## C. Key Question T-3: Disturbance Patterns

*T-3. What are the historic and current disturbance patterns for the watershed? How have management activities affected these patterns?*

### 1. Pre-settlement Period

Fire appears to have been the most dominant, frequent disturbance in the watershed and a major determinant of biological diversity. The pre-settlement fire regime (pre-1850) was one of generally frequent, low to moderate severity fires. These fires burned through a landscape of complex topography, diverse vegetation and areas of previous disturbance, which affected the fire severity. Fires were generally low intensity surface fires with occasional higher intensity, stand replacement patches. The result was a patchy landscape where higher severity burned patches were interspersed within a larger area of low intensity, under-burned areas. Large-scale stand replacement patches of hundreds to thousands of acres were infrequent for the watershed's landscape.

Fire not only altered stand development by returning vegetation to earlier successional stages, it often served to maintain plant communities at later successional stages with frequent low intensity under-burns. These frequent fires influenced the structural characteristics, species composition, and density of stands. Surface fuels were kept at low levels, under-stories were relatively clear of trees and vegetation that could serve as ladder fuels, and stands were generally more open than today.

Fire created openings and provided favorable conditions for regeneration and growth of shade-intolerant species (such as the pines and non-tanoak hardwoods). The more fire resistant/fire adapted species were favored by survival through subsequent fire events. Under-burns favored those species and created stand structures adapted to these fire conditions. The more shade-tolerant and less fire resistant species, such as white fir or tanoak at lower elevations, would also have regenerated in openings and in the under-story. However, subsequent fires would have kept their numbers relatively low, especially in the under-story. The more mesic sites generally experienced longer fire return intervals and were the places where, at higher elevations, white fir dominated stands often developed. Low stand densities often improved or maintained the growth of larger, older trees and maintained early seral species as a minor to major part of most stands.

Other disturbances, such as mass soil movement (landslides), floods, wind, and insects or pathogens also played a role in determining vegetation diversity, but they were of a more localized or infrequent nature. Wildfire exclusion has resulted in significant increases in both stand densities and the proportion of shade-tolerant and fire sensitive species. Although there is more vertical structure (multi-storied) at the forest stand level, at the landscape level there is less diversity, stands are more homogenous, and canopy closures have increased. These changes can be expected to increase the future effects of disturbances by insects and disease as well as fire in the watershed.

Fire also affects geomorphic processes within a watershed (Swanson, 1981). Fire alters vegetation and soil properties, which can alter hydrologic and geomorphic processes. The effects are generally increased soil water and overland flow, which can result in accelerated erosion by a variety of surface and mass movement processes. The magnitude of geomorphic effects of fire depends on the fire regime (primarily frequency and severity) and the sensitivity of geomorphic systems to disturbance by fire. Geomorphic sensitivity is controlled by hill-slope and channel steepness and the effectiveness of vegetation in regulating physical processes in the system. Fire is less geomorphically significant in ecosystems where fire is less frequent and/or less intense and where erosion potential is lower. A changed fire regime in the watershed may result in more and larger patches of high severity fire that could increase surface erosion, mass movement processes, and reduce water quality.

### 2. Settlement Period

During the Euro-American settlement period (post-1850), mining, farming and grazing were significant new disturbances in the watershed (see discussion in the Social Module). Early mining activity was concentrated in lower elevation streams and adjacent riparian areas (McKinley and Frank 1995). They noted that in areas such as the Althouse region and the East Fork Illinois around Waldo, the streambeds were virtually turned upon themselves. Ditches and water diversions changed water flow patterns (32 miles of ditches and flumes in the Indian Hill, French Flat, Waldo and Takilma areas), deciduous and conifer trees in the way of mining operations were removed, and the soil was washed away.

Mining activities heavily impacted many areas in the watershed including:

*Allen Gulch (40-8-34)*: Approximately 80 acres of Allen Gulch has forest vegetation growing on placer mine debris. This land is located in the southwest 1/4 of the northeast 1/4 (approx. 15 acres), the southeast 1/4 of the northwest 1/4 (approx. 25 acres), the northeast 1/4 of the southwest 1/4 (approx. 30 acres), the northwest 1/4 of the southeast 1/4 (Shenon 1933). Smaller diameter trees occur just downhill from the Allen Gulch cemetery indicating more intense or more recent disturbance. Below that, the trees are larger and demonstrate the ability of closed canopy forest vegetation to re-establish itself even after severe disturbance. Second-growth timber including trees 50 to 60 years old covered most of the mined ground in Allen, Sailor, and other gulches, and fixes rather definitely the time elapsed since that mining period (Shenon 1933). This would approximate the end of the mining at around 1878.

*Scotch Gulch (40-8-33 and 41-8-3)*: Sluice boxes were used to separate the gold from rocks and dirt. One of these, operated in Scotch Gulch in the 1870s was said to have employed as many as 50 men, shoveling, piling rocks, etc. (Street and Street 1973).

*Esterly Mine (40-8-22)*: The most extensive mining was done by the hydraulic method. Nozzle diameters of two to six inch diameter with water pressures commonly up to 150 psi were used. With this, large boulders and tree stumps can be rolled out of the way, high banks undermined and caved and an immense amount of dirt washed through a sluice in a day. The Easterly mine is said to have handled five hundred to one thousand cubic yards of dirt per day by this method (Street and Street 1973).

Wetland areas were among the most intensely disturbed by mining and farming practices. Streams were channelized, and the once more extensive marsh areas likely found at various locations along the lower East Fork, and where side drainages joined the river (McKinley and Frank 1995) were turned into farmlands or pasture. Early homesteads were primarily in the more open vegetation types (Hickman 1998), that were easier to graze or prepare for farming than more heavily wooded areas.

Timber harvest began close to areas of human activity such as Waldo and Takilma in the early mining days (McKinley and Frank 1995). The big pines scattered amongst the oak savannah, woodlands and lower elevation mixed-conifer forests were often harvested. They provided much of the lumber for sluices, fences, homes, stores and barns. Oaks were also often removed as barriers to agriculture and pasture, and provided a source of fuel wood.

The steeper lands, lack of railroad access and generally poorer stands of timber compared to the Southern Cascades, delayed significant logging in the Illinois Valley area until after the turn of the century. Private lands were largely logged first and significant timber harvest did not begin from National Forest and BLM administered lands till after World War II. Particularly in the early years, pine was the most valuable species and was often preferentially harvested from private lands.

Surveyor's notes from the Donation Land Claim (DLC) surveys of 1850 to 1855 reveal a landscape in lower elevations of the Upper Illinois Valley that was dominated by black oak, white oak or ponderosa pine. The average diameter of these species was significantly less than for other surveys, such as the Applegate, suggesting that as a whole the Illinois Valley DLC's were a younger age (McKinley and Frank 1995).

With the success of fire suppression resulting in fire exclusion on many sites, the vegetation composition has changed. A good example of this can be seen in the monument trees in the French Flat area. At the southeast corner of section 15 (T40S, R8W) the bearing trees in 1855 were: a yellow pine 24" dbh, and 3 black oak 2", 4", and 8" dbh. In 1957, the bearing trees at the same corner were an oak (no species listed) 9" dbh, and three Douglas-fir, 10", 12", and 15" dbh. At the quarter corner between section 22 and 23, the bearing trees in 1855 were 2 black oaks: 3 and 6 inches in diameter. The bearing trees in 1957 at this corner were 2 (Douglas) firs: 10 and 17 inches in diameter. This change in bearing trees over time (102 years) supports the notion of fire tolerant, shade intolerant trees (in this case ponderosa pine and black oak) are being replace by more shade tolerant fire intolerant trees (Douglas-fir).

Borgias (1997) noted the changes to the ponderosa pine-black oak woodland and white oak savanna that once dominated the French Flat area of the watershed in a comparison of land surveyor's notes. The cessation of fire use by Native Americans, fire suppression, grazing, and selective harvest of pines allowed Douglas-fir to encroach, and in some cases overtop what was once open oak savannah and pine-oak woodland. The forest is now denser, the edge between denser forest and openings of scattered pine and oak reduced, and the role of pine diminished.

## D. Key Question T-4: Fire Hazard

*T-4: What is the existing condition of fire hazard on the perimeter of the rural interface, and what can be done to improve those fire hazard conditions?*

See Map 21 (Fire Hazard Levels) for existing condition.

White oak and pine communities occur within the rural interface. Fire exclusion has allowed encroachment by shrubs such as ceanothus and tree species including incense cedar and Douglas-fir, resulting in increased fire hazard. Prescribed burning in conjunction with manual or mechanical treatments may be appropriate for reducing this hazard.

Tanoak communities within the rural interface also present a fire hazard, which could be reduced through the use of prescribed fire and other mechanical treatments.

Young stand management (less than 50 years) is a priority. Embark on a young stand management plan (brushing, precommercial thinning, hand piling and burning the resulting slash) in natural stands as well as old clear cuts. "Link" treatments: projects should not be seen as single events, but rather a sequence over time culminating in desired future condition. For example, stand initiation (new age class) to initial canopy closure of the desired number of trees by species per acre. This would incorporate multiple treatments over a 10 to 20 year project window and enhance planning/budgeting efforts.

## E. Key Question T-5: Timber Harvest

*T-5. How much timber was harvested in the watershed in the past? How much timber volume is available on the lands allocated to Matrix?*

### 1. National Forest Lands

Timber harvest began in the lower elevations in the 1940's and progressed with the development of the transportation system. Approximately 7,238 acres have been regeneration harvested in the past five decades (see Map 15 Managed Stands). The highest levels of harvest in terms of acres regenerated occurred during the 1950's and 1980's. The 1990's saw a reduction in harvest from historic levels with the Dwyer injunction and the subsequent Northwest Forest Plan amendments to the Siskiyou Forest Plan.

With regard to land now in the Matrix land allocation, approximately 1,700 acres (39% of the lands suitable and available for timber harvest) have been regeneration harvested during the past five decades (See Table T-13).

| Table T-13: Historic Regeneration Harvest in the current Matrix land allocation - National Forest Lands (Includes intermittent streams and unsuitable lands) | | | |
|---|---|---|---|
| Decade | Management Areas in the Matrix (acres) | | |
| | Partial Retention | General Forest | Total |
| 1940-1949 | 36 | 11 | 47 |
| 1950-1959 | 267 | 463 | 730 |
| 1960-1969 | 65 | 460 | 525 |
| 1970-1979 | 132 | 157 | 289 |
| 1980-1989 | 282 | 426 | 708 |
| 1990-1999 | 37 | 0 | 37 |
| Totals | 819 | 1,517 | 2,336 |

The following table displays the approximate acres available for Forest Service programmed timber management in the watershed.

| Table T-14: Matrix Acres Available for Timber Harvest - National Forest Lands | | | |
|---|---|---|---|
| | Management Areas in the Matrix (acres) | | |
| | General Forest | Partial Retention | Total |
| Matrix Acres - Total (1) | 5,058 | 2,407 | 7,465 |
| Unsuitable (2) | (931) | (551) | (1,482) |
| Managed Late-Successional | (107) | 610 | (168) |
| Intermittent (3) | (936) | (562) | (1,498) |
| Net Available Acres | 3,084 | 1,233 | 4,317 |

(1) Does not include fish bearing or perennial non-fish bearing Riparian Reserves.
(2) TMR and TML. Lands unsuitable for timber management.
(3) Approximate from maps, aerial photos, and ground verification.

Potential Sale Quantity (PSQ) was modeled in the Siskiyou Forest Plan using suitable and available lands over the entire forest for sustained timber yield calculations. PSQ was adjusted for the reduction in the land base available for timber management after the Northwest Forest Plan Record of Decision (ROD). PSQ is <u>not</u> modeled at the watershed scale. A watershed is not considered a sustained yield unit.

Approximately 3,500 acres of managed stands in the watershed were harvested prior to 1970 (all land allocations). Many of these stands may require thinning within the next ten years to maintain current growth rates, species diversity, and reduce long-term fire hazards. The potential thinning opportunities are displayed in the <u>East Fork Watershed Analysis Commercial Thins</u> (efcomthin.gif).

2. BLM Lands

Table T-15 summarizes past timber harvesting on BLM lands in the watershed. The earliest dated harvest on BLM Lands in the watershed was 1956 in T39S,R8W, Section 27. Between that time and 1985 some type of timber harvest was done on approximately 1,834 acres (36.4% of BLM lands) received. Harvest type and volume removed are data gaps.

| Table T-15: Pre-1986 Timber Harvest Acres by Township - BLM Lands | | | |
|---|---|---|---|
| DECADE | T39S, R7W | T39S, R8W | T40S, R8W |
| PRE 1960 | 0 | 140 | 236 |
| 1961-1969 | 0 | 0 | 311 |
| 1970-1979 | 59 | 238 | 169 |
| 1980-1985 | 361 | 320 | 0 |
| **Totals** | **420** | **698** | **716** |

Source: BLM microstorms data**. NOTE:** Harvest acres are greater than actual because inventory units include some acres outside of the watershed boundary. Acreages also assume no units were harvested more than once, and subsequently counted more than once.

For the period from 1986 to the present, approximately 444 acres (8.8% of BLM lands) and 6,961 MBF have been was harvested in the watershed.

| Table T-16: Post 1986 Timber Harvest Acres and Volume - BLM Lands | | | | | | |
|---|---|---|---|---|---|---|
| DECADE | T39S, R7W | | T39S, R8W | | T40S, R8W | |
| | Acres | MBF | Acres | MBF | Acres | MBF |
| 1986-1989 | 91 | 819 | 138 | 1,167 | 85 | 1,859 |
| 1990-1999 | 0 | 0 | 130 | 3,116 | 0 | 0 |
| **Totals** | **91** | **819** | **268** | **4,283** | **85** | **1,859** |

Source: BLM microstorms data**. NOTE**: Harvest acres are greater than actual because inventory units include some acres outside of the watershed boundary.

In total, approximately 2,278 acres or 45.2% of the BLM administered lands have had some form of harvest on them. Current estimates show 32,105 MBF remaining in the watershed on 1,599 acres (31.7% of BLM lands).

| Table T-17: Estimated Current Timber Volume on BLM Lands | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Township | T39S, R7W | | T39S, R8W | | T40S, R8W | | T41S, R8W | |
| | Acres | MBF | Acres | MBF | Acres | MBF | Acres | MBF |
| Totals | 539 | 6,550 | 431 | 8,900 | 556 | 14,600 | 73 | 2,000 |

Source: BLM microstorms data.

### 3. LRMP and RMP Timber Management Recommendations for Timber Management

The following summarizes the timber management recommendations from the National Forest LRMP and the BLM's RMP for lands in the matrix land allocation.

a. National Forest Lands

- Produce a commercial timber yield.
- Maintain an appropriate distribution and abundance of age classes to ensure sustained yield.
- Provide early-successional wildlife habitat.
- Maintain a diversity of species, such as pines and hardwoods, appropriate for the site.
- Commercial thin stands to maintain desired species composition and stand structure,

promote long-term tree and stand health, reduce fire hazard, and salvage potential mortality.
- Pre-commercial thin/release young stands to maintain desired species, stand structure and development rates.
- Treat stands early (within 10 years of stand initiation) to reduce potential fire hazard from fuel accumulations.

b. BLM Lands

- Produce a sustainable supply of timber and other forested commodities to provide jobs and to contribute to community stability.
- Provide connectivity (along with other allocations such as Riparian Reserves) between Late-Successional Reserves.
- Provide habitat for organisms associated with both early as well as late-successional forests.
- Provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees.

## F. Key Question T-6: Stand Densities and Pathogens

*T-6: How has and how will stand densities and tree pathogens affect the watershed?*

Tree mortality is a normal part of forest ecosystem processes. Insects, disease, drought, fire and competition with other trees and vegetation will kill trees. The patterns of mortality are complex. Mortality resulting from disturbances is determined by: vegetation structure and patterns, the type of disturbance, and the physical environment (USFS 1996). For example, dense stands increase the competition for available water and result in greater moisture stress to vegetation. During periods of drought, mortality can occur directly from drought stress or more likely from combinations of drought induced stress and subsequent insect attacks. Insects are often host specific, and more aggressive insect species can impact some tree species more than others.

Generally above the riparian zone in a riparian reserves, the vegetation is the same as the uplands and responds similarly to upland disturbances. Riparian reserves incorporate substantial areas of upland vegetation, especially along intermittent stream courses. Fluvial action (frequency, intensity and duration of high flows), high water tables, cold air accumulation, and topographic shading are key non-biotic features of riparian zones in mountainous terrain. Riparian-vegetation is strongly influenced by the environment created by fluvial processes. The vegetation is affected by direct stream flow and the substrates (gravel, silt, etc.), local water table conditions, and land forms created by fluvial activities.

1. Stand Density

Fire played a major role in the development and maintenance of late-successional forest structures in all plant series in the watershed (USDA 1993, Tappeiner et al. 1997, Agee 1991, Taylor and Skinner 1998). Tappeiner noted that the wide range of ages and low density of old stands in the Coast Range suggested that periodic, low intensity fire killed some trees, temporarily reduced shrub cover, and likely enabled some seedling establishment. A combination of available seed source and dense shrub and herbaceous competition may have limited conifer establishment after intense fires (even on productive sites). Self-thinning did not generally occur during the development of old stands although it likely occurred in dense parts of some stands. Canopy gaps in these forests were the result of the low rate and irregular density of conifer establishment as well as the death of individual large trees.

Taylor and Skinner (1998) described a fire regime in Northern California where frequent fires of mixed low and moderate severity killed some over-story trees, initiated recruitment, and thinned or killed understory stems. These mixed-severity fires created multi-aged stands where tree establishment was associated with more severe fires that killed parts of the canopy and opened the stand enough for regeneration to occur. Agee (1990) also described a similar stand development sequence for the Oregon Caves National Monument.

Stand density greatly influences stand development and the resulting stand structure. Given the initial species composition, initial density, site conditions, and past as well as future disturbance factors, forest stand development can be predicted (Oliver and Larson 1996). Patterns of stand development at different stand densities are well documented in the literature. Reineke (1933) showed that each species has a different maximum number of trees of a given diameter that a site can support (maximum size-density relationship). Fewer trees can be supported as diameter increases, and even fewer shade intolerant species (ponderosa pine) can be supported than shade tolerant species (white fir). Drew and Flewelling (1979) showed that these patterns are useful for achieving desired stand structural characteristics such as crown structure, individual tree and stand growth, tree diameter distribution, under story development, regeneration, and species composition. Above 25% of their maximum stocking level, individual trees begin to compete with each other and individual tree diameter-growth slows and crown lengths shorten. Above 55% of their maximum stocking level, stands enter a zone of "imminent competition-mortality" where the risk of mortality increases.

Stand densities on BLM administered lands in the watershed are high. During 1999, stand exams were conducted on approximately 1,000 acres in T40S, R8W. Stand densities were measured using the Curtis relative density index. This index was derived from the ratio of current stand basal area to the maximum stand basal area. Using this system, a stand is ready for thinning when the relative density reaches 35 and at the upper limit for thinning when the relative density reaches 55. All 1,000 acres examined in 1999 have relative densities greater than 55. This indicates that in this township all the stands visited can be characterized by slow rates of growth and a shift in species composition. Shade intolerant/fire tolerant species are declining while shade tolerant/fire intolerant species are increasing, and there is good potential for a stand destroying fire. From tree and stand growth and vigor perspective, these stands should have already been thinned.

Many early-seral stands in southwest Oregon are not developing along the same stand trajectories as existing late-successional stands (Tappeiner 1997, Sensenig 1998). Stand densities are higher and individual tree diameter growth rates lower than those of old stands. Higher stand densities reduce tree vigor, increase tree losses to insect attacks, increase competition-induced mortality, and delay the development of old growth structural characteristics. Reducing the density of forest stands can maintain stand vigor, species diversity, and accelerate the development of large trees.

2. Density Management

Commercial thinning is a silvicultural technique that can be used to meet local economic needs for timber, ecosystem restoration goals for wildlife, and a variety of other resource objectives. The amount of time to reach mature and old growth forest habitat conditions varies considerably between no density treatments and various types and intensities of density treatments. In the absence of density management actions, higher stand densities, increased tree pathogens, and more stand replacement fires will result. This would result in less old growth, more early seral vegetation, and more negative impacts to species of concern. Treatments that reduce stand densities could, over time, lessen the potential for high intensity fires, increase the amount of mature and old-growth forest, produce wood for human uses and maintain some historic forest conditions. The amount, location, and timing of these treatments could significantly affect how long it takes to reach any particular specified desired future condition. For example, with density management on relatively productive areas (McArdle Site III) found on National Forest land, a stand can develop into mature forest habitat (8 to 16 trees per acre @ 21” to 32" dbh) within approximately fifty-five years after a stand replacement event, and it can develop some old growth characteristics (8-16 mature trees and 8-16 trees larger than 32" dbh per acre) within about ninety years. However, without density management, the same stand could be at higher risk to diseases and stand replacement fire without treatment. Assuming no disease and no stand replacement fire, a stand would take about one hundred ten years to develop into mature forest and over 180 years to develop old growth forest habitat characteristics (*i.e.*, trees > 32” dbh) without density treatment (see Figure T-1). Along with large diameters, the development of mature and old growth forest also requires snags, down woody material, and deformities such as mistletoe brooms, large limbs, and cavities. Silvicultural treatments can promote the development of these characteristics.

Figure T-1: Years to Reach Mature or Old Growth Forest Habitat

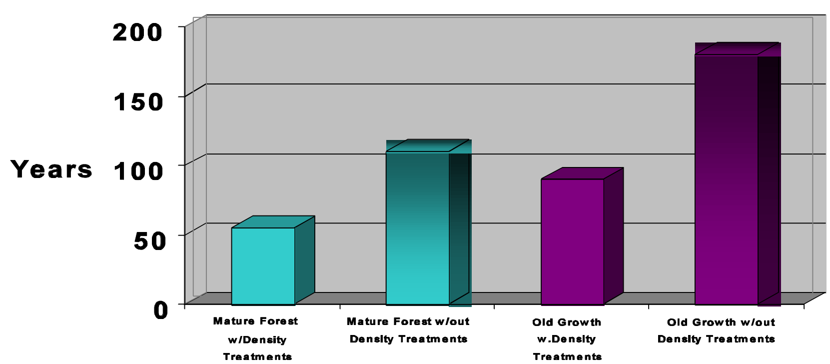



Table T-18 presents growth modeling results for different initial stand densities and thinning regimes to show the resultant stand size and densities. In doing this modeling the assumptions made were: a) competition from other vegetation is minor (e.g., low intensity prescribed under-burning or mechanical thinning will occur to reduce competition with trees intended to develop into mature and old growth forest habitat) and b) stand treatments would be designed to maintain minor species on appropriate sites (e.g. hardwood species in the Tanoak and Douglas-fir Series).

| Table T-18: Density Treatment Scenarios | | | | | |
|---|---|---|---|---|---|
| Trees Per Acre (tpa) Planted | 1st Thin pre-commercial | 2nd Thin commercial | 3rd Thin commercial | > 21" dbh | > 32" dbh |
| 400 10'x10' | No treatment | No treatment | No treatment | 13 tpa about 110 years after planting | 6 tpa about 160 years after planting |
| 300 12'x12' | To 125 tpa (19x19) about 10 years after planting. | No treatment | No treatment | 21 tpa about 60 years after planting | 20 tpa about 100 years after planting. |
| 300 12'x12' | To 125 tpa (19x19) about 10 years after planting. | Treat about 40 years after planting. | No treatment | 29 tpa about 60 years after planting | 12 tpa about 95 years after planting. |
| 300 12'x12' | To 125 tpa (19x19) about 10 years after planting. | Treat about 50 years after planting. | No treatment | 16 tpa about 55 years after planting | 11 tpa about 90 years after planting |
| 300 12'x12' | To 125 tpa (19x19) about 10 years after planting. | Treat about 55 years after planting. | No treatment | 25 tpa about 60 years after planting | 13 tpa about 90 years after planting |
| 300 12'x12' | To 125 tpa (19x19) about 10 years after planting. | Treat about 55 years after planting | Treat about 75 years after planting | 25 tpa about 60 years after planting; 17 tpa about 100 years after planting | 12 tpa about 90 years after planting; 20 tpa about 100 years after planting |

### 3. Insects

Relatively high levels of mortality in large, old sugar pine due to mountain pine beetles (*Dendroctonus ponderosa*) have been observed in the past decade in the watershed and elsewhere in southwest Oregon. Bark beetles do not normally kill healthy and vigorous trees. Rather, they are most successful on low vigor or stressed hosts. Sugar pines are intermediately drought tolerant when they are young, but become less tolerant as they become older. Bark beetles prefer trees weakened by disease, injury, drought, or intense competition. The major factors contributing to high levels of mortality include the recent years of drought; dense stand conditions and blister rust. The basal area that a particular site can carry and maintain stand vigor varies depending on site productivity. In portions of southwest Oregon on pine sites recommendations are to maintain basal areas of less than 180 square feet on moderate to good sites and less than 140 square feet on poor sites to reduce the risk of mountain pine beetle attack (Don Goheen, personal communication). Understory vegetation of small trees and brush are also significant competitors for moisture, especially on poorer sites, and will increase the risk of beetle attack.

Map 16: the Risk of Decline in Forest Health shows areas at risk to bark beetle attack in the watershed (USDA 1995).

### 4. White Pine Blister Rust

White pine blister rust (*Cronartium ribicola*) is an introduced disease that affects five needle pines (sugar and western white pine) in the watershed. It causes top and branch killing, tree mortality, and weakens trees, which contributes to bark beetle attack. Blister rust has contributed to greatly reducing the numbers of five needle pines in the watershed over the last 50 years, especially western white pine. This has resulted in a loss of genetic diversity, shifting stand structure on some sites, and an increase in snags (Jimerson 1992). Douglas-fir and white fir have replaced the sugar pine on some sites, which because of their susceptibility to some root diseases and mistletoe, have contributed to poor stand health and productivity. Risk of infection with blister rust is greatest on sites where summer and autumn fog persist, such as low-lying riparian areas, saddles, and ridges toward the coast side of the watershed. Blister rust tends to intensify in years following particularly wet late summers and falls. Effects of blister rust are minimized when five needle pines are favored on low risk of infection sites, and when rust resistant pines are favored or planted.

5. Dwarf Mistletoe

Dwarf mistletoes (*Arceuthobium spp.*) are widely distributed on Douglas-fir and white fir in the watershed. They are less common on the pines, although lower elevation Jeffrey and ponderosa pine can be severely infected. Douglas-fir dwarf mistletoe in particular can cause decreased growth, stem and crown distortion, and the potential for tree mortality. Growth losses can often exceed 60% and are most significant when the upper halves of the crowns are infected or brooms exceed more than 30% of a tree crown. While growth rates may be reduced, mistletoe brooms and deformities provide valuable wildlife habitat. Many wildlife species utilize such trees for nesting, roosting and foraging, as well as using the aerial stems of plants for food.

Fire is considered one of the primary factors affecting dwarf mistletoe distribution (K. Marshall, personal communication). Many areas probably have more mistletoe-infected trees and more heavily infected individual trees now than in the past due to fire exclusion. Frequent fires probably killed many infected trees due to the flammability of large brooms and accumulations of ground fuels in heavily infected stands. Fire exclusion also has increased the density and continuity of host species, and led to an increase in multi-storied stands. Uneven-aged management and partial cutting in infected stands can in some instances promote mistletoe spread and intensification. Mistletoe, particularly in Douglas-fir, can significantly reduce the vigor, growth and potential for development of large trees. Existing large trees with the classic brooms preferred by wildlife probably were not infected early in life. They more likely developed heavy infections after they were mature. Dwarf mistletoe effects are minimized in single-storied stands, stands where infected over-stories are removed before the under-story becomes infected, and when non-host species can be favored in mixed species stands. Thinning can also increase growth rates in even moderately infected stands.

6. Root Disease

Several root diseases are also found in the watershed. The most significant are Armillaria root rot (*Armillaria ostoyae*), annosus root rot (*Heterobasidion annosum*), and laminated root rot (*Phellinus weirii*). Armillaria can occur on any conifer species, but has its greatest effects on white fir and Douglas-fir. Annosus affects true firs. Laminated root rot has its greatest effects on white fir and Douglas-fir, and to a lesser extent red fir. These root diseases cause host tree mortality, and are diseases of the site. The pathogens can survive for decades in infected roots and stumps. Trees are infected when their roots contact old infected roots or grow into the vicinity of a root rot center. The centers typically expand at the rate of 1 to 3 feet per year. Wind borne spores that colonize recent stumps or tree wounds also spread Annosus. All root diseases are favored by stands with high densities of susceptible trees, especially when they are near existing root disease centers. Armillaria is favored by host tree stress, annosus by stumps and wounded trees, and laminated by available host trees. Past management activity and fire exclusion have favored increased root disease effects. Fire exclusion has increased both the density and distribution of host species. In managed areas, stumps and wounds have increased the spread of annosus, and failure to recognize disease centers and replanting with susceptible species has increased potential disease losses. Maintaining tree vigor and favoring resistant and immune species adapted to the sites minimize root disease effects.

*Phytophthora lateralis* is a major root disease of Port-Orford cedar (POC). Port-Orford Cedar is distributed mainly within riparian areas primarily on National Forest Lands (see Map 18: Port-Orford Cedar Detections & Disease). The density of POC is generally low in the watershed (<5 % canopy closure) except within narrow riparian corridors.

Two factors are primarily responsible for the distribution patterns of POC: summer water availability and fire (Zobel et al. 1985). Summer water availability is related to many factors, including soil moisture, topography, geology and microclimate. The watershed receives less than 7 inches of dry season precipitation (Froelich and McNabb 1986), which are some of the drier sites on the Siskiyou National Forest. POC is limited to micro-sites that assure a consistent water supply, such as areas with moving subsurface or surface water, slumped topography with seepage, and slopes with sufficient watershed above to maintain seepage. POC is often limited to stream valleys, lower slopes or to northerly slopes where late summer water potentials are highest. Fire also has a major influence on the distribution of POC. Historic frequent fires may have eliminated POC from drier micro-sites. POC is more susceptible to fire than associated conifers in the seedling and sapling stages. This may not have allowed POC to become established where fires were frequent or more severe.

POC reproduction is apparently becoming established away from more typical wetter riparian sites. This is likely a result of longer "fire free intervals" associated with fire exclusion, and management related disturbances, such as road construction, that create locally wet micro-sites. Whether sufficient summer moisture will be available on these sites to allow these trees to continue to survive and grow is unknown.

Port-Orford cedar is ecologically significant in the watershed. It is the most shade tolerant conifer within its range and a contributor to diversity in mixed species stands. It is the primary conifer and often the largest tree species in riparian areas on ultramafic soils. It can significantly improve soil fertility by incorporating calcium into ultramafic soils. POC is a common component of many riparian areas where it provides large tree structure, shade, and superior long lasting downed wood that enhances stream structure and fish habitat.

Once introduced into a stream-course, POC root disease usually kills most of the POC downstream and within two to three crown radii of the last infected cedar. The extent of mortality appears (anecdotal) also be dependant on stream gradient and amount of water flow. Where the map displays infestation high in a stream-course, the stream reaches below are also likely infested. Mortality occurs over a period of years and is slowest where POC is scattered. POC is presently not significantly impacted by the root disease on dry micro-sites. Most of the lower elevation main drainages in the watershed are infested, particularly Elder, Little Elder, and Page Creeks. The west side of the watershed and the upper reaches, in the East Fork and Dunn Creek, are presently not infested. There is uninfested POC in Allen Gulch and Khoerry Creek. Adjacent watersheds to the west (Knopti Creek, Middle Fork of the Smith, Elk Creek, and Wood Creek) have varying levels of infestation. The Siskiyou Wilderness and tributaries to the Klamath River drainage are not currently infested. (see Map 18: Port-Orford Cedar Detections & Disease).

Infestation with root disease is highly dependent on the presence of free water in the vicinity of POC roots. High risk areas are stream courses, low-lying drainage areas down-slope from infested areas, or areas below roads and trails where inoculums may be introduced. The greatest potential for loss of POC from root disease in the East Fork watershed would be from introductions into the headwaters of either Dunn Creek or the main East Fork. The existing road systems and several trails access the headwaters through infested areas.

a. Recommendations for Port-Orford Cedar Root Disease

POC disease containment strategies have been utilized in the watershed for many years. Strategies have included: road decommissioning, seasonal road closures, road sanitization, road drainage and surface improvements, and limited operating seasons for high-risk activities. Preventing further spread of the disease should focus on limiting the movement of contaminated soil and water, and removing susceptible hosts from high-risk areas. Specific recommendations for National Forest Lands in the watershed are to:

- Restore POC distribution and abundance;
- Maintain current disease control strategies (education, sanitation, vehicle washing, etc);
- Finish the commercial sanitization on roads 4803 and 4808;
- Improve the road surface and drainage on the Sanger Peak tie road;
- Restrict wet season access on the 4808.019 spur with either a gate or a barricade; and
- Maintain or improve drainage and road surfaces to reduce POC infestation risk on open roads with POC presence.

The recommendation for BLM lands is to use the current Port-Orford management guidelines.

## G. Key Question T-7: Road and Transportation Systems

*T-7. What are the road network and maintenance needs for managing recreation, fire, timber sales, and habitats for species of concern?*

See the roads discussion in the Aquatic Module.

## H. Key Question T-8: Maintenance and Restoration Priorities

*T-8. Where are the priority areas for terrestrial maintenance and restoration treatments?*

This question is answered within other questions and the Synthesis Module.

# I. Key Question T-9: Soil Conditions

*T-9. What are the trends in erosional and other soil conditions in the watershed? What can be done to restore and maintain desired conditions?*

## 1. Soil Types

Rock type and geologic history, along with slope, aspect, and climate, determine the soil types that develop from weathered bedrock. Table T-20, Soil Types, shows the percentage of each of the dominant soil types within the watershed. California and Oregon soils were mapped by different people at different times and, therefore, some discrepancies exist, such as truncated soil types at the state border and significant mapped acreage in Oregon (with none in California) of mixed ultramafics and metasediments/metavolcanics.

Table T-19: Soil Types

| Soil Type | California (acres) | Oregon (acres) | Total acres | Percent |
|---|---|---|---|---|
| Alluvium | 315 | 6,769 | 7,084 | 11% |
| Granitics | 6,190 | 534 | 6,724 | 11% |
| Metasediments/metavolcanics | 10,888 | 12,466 | 23,354 | 37% |
| Mixed metased./metavolcanics | 0 | 7,686 | 7,686 | 12% |
| Ultramafics | 7,488 | 4,341 | 11,829 | 19% |
| Other | 453 | 6,758 | 7,211 | 11% |
| Total | 25,334 | 38,554 | 63,888 | 100% |

The following section outlines a brief description of the soil types found in this watershed and are grouped according to parent material (See Map 5: Parent Material and Soil Depth). *Geology and Mineral Resources of Josephine County, Oregon* (1979) and *Geologic Mapping of the Weed Quadrangle, California* (1987), *Geology and Mineral Resources of Josephine County, Oregon* (1979), *Soil Resource Inventory, Siskiyou National Forest*, (1979) and *Soil Survey of Josephine County, Oregon* (1983) were used to determine rock and soil types in the area.

### a. Sedimentary, Metasedimentary, and Metavolcanic Derived Soils

Soils developed from sedimentary, metasedimentary, and metavolcanic rock (Applegate Group and Rogue/Galice geologic formations) in this watershed tend to share some basic properties, but show a wide range of characteristics depending on site-specific lithology and geomorphology. Soil depth can vary from 20 to 60 inches. When these soils are found in the uplands, they are typically formed from colluvium. These soils tend to have moderate amounts of surface organic matter and leaf litter. Drainage is moderate to well-drained, and permeability is moderate to rapid. Surface erosion potential is generally slight to moderate, and increases to severe in proportion to slope. Soil turbidity potential can also be variable, ranging from low to high. Rock content is extremely variable and may or may not increase with depth, ranging from 3 - 60% in surface horizons and 10 to 85% in subsurface layers. Productivity on these sites is moderate to high. In fact, Josephine and Pollard soils have the highest site index rating (a measure of productivity) in the county and constitute more than 5,000 acres in the watershed.

### b. Ultramafic Soils

Ultramafic rocks, such as peridotite and serpentine, with peridotite less resistant to weathering at surface conditions than serpentine, often weather to lateritic soils (red soils high in iron and aluminum content). Peridotite soils have low productivity with sparse vegetative cover and little duff or litter to protect soils from surface erosion. These areas are often referred to as red flats or red barrens. Ultramafic areas are characterized by gentle to moderate slopes, deep red soils, rocky inclusions and outcrops, and plant species endemic to serpentine minerals. Soils vary in depth from shallow to deep (10 to 60") and have moderate to good drainage. Permeability is slow due to clayey subsoil, which may result in seasonally perched water tables. These soils have very little organic matter in surface layers or undecomposed surface litter. Of all the soil types in the watershed, ultramafic soils can have the greatest rock content throughout the soil profile, ranging from 40 to 80%.

Reflecting the chemistry of the parent materials, ultramafic soils have low levels of calcium, high magnesium, and high concentrations of toxic heavy metals such as nickel and chromium. Therefore, plant communities on ultramafic soils are limited to species that can tolerate the unusual chemical makeup of serpentine and peridotite. Soil surface layers range in texture from clay loam to extremely stony clay loam. The subsoil horizons range in texture from cobbly to extremely cobbly clay. Textures in serpentine soils are generally high in clay and coarse fragment content compared to soils developed from metamorphic parent materials. Productivity is generally low in these soils though one soil (Cornutt) is moderately productive due to greater soil depth and mixed mineralogy that is only partially serpentine. Because of high clay content and lack of vegetative cover (including protective duff and litter), serpentine soils are susceptible to surface and gully erosion. Serpentine soils have low load bearing capacity, especially when saturated, and therefore commonly lack stability and are susceptible to mass movement (debris slides, cut and fill slope failures). These soils are also quite susceptible to damage from mechanical disturbance and compaction due to the clay content and lack of organic matter (duff and litter layer) at the surface. Runoff from bare soil generally has high turbidity and high amounts of suspended sediment, which can have a direct impact on stream water quality.

### c. Granitic Soils

Much of the granitic rock in the area is deeply weathered or decomposed to form deep, sandy soils with low cohesion and are subject to surface erosion. Most areas have one to three inches of partially decomposed or un-decomposed leaf litter, good to excessive drainage and moderately rapid permeability. Site productivity is moderate. Soil turbidity potential is low. Rock content in surface layers ranges from 45-60% and may increase or decrease with depth to 20-70% rock fragments. Granitic soils occur only on National Forest land in this watershed; none are mapped on BLM portions.

### d. Alluvium

The alluvial soils occurring along the major river and stream corridors are among the deepest in the watershed. Several processes have combined to create the deep, sediment-filled valley, which is unique in the Klamath Mountain. These include fault movement creating temporary dams in the Illinois River, glaciation, rapid stream cutting and deposition from tectonic uplift, and severe climatic changes. Because the sediments have experienced limited transport, rock content in the soils can be high; however, the high gravel and cobble content does not appear to adversely affect drainage or create droughty conditions. Alluvial soils also can have the greatest amount of organic matter and stability (due to slight slopes), lowest erosion hazard, lowest turbidity potential and greatest productivity.

2. Data Gap

There is no survey of slides for BLM and other lands in this watershed.

3. Recommendations

• Manage roads to reduce their contribution to erosion processes such as landslides, surface erosion, stream diversion, and gully formation. Minimize or avoid new road construction on granitic or serpentine soils.

• Decommission unnecessary roads as identified through the interdisciplinary process. To minimize soil disturbance or gully formation, evaluate the appropriateness of ground disturbing restoration techniques such as scarification and ripping. Evaluation should include parameters such as slope gradient, aspect and soil type.

• Numerous recent failures are associated with older landslide forms. Map ancient and inactive erosional forms to help guide future management decisions.

• On granitic and ultramafic soils, minimize or avoid soil disturbance by using appropriate and site-specifically determined logging systems, road location and design, prescribed fire, silvicultural, and restoration techniques.

• Monitor fire effects on ultramafic soils to determine short and long term erosion hazards following burning.

## J. Key Question T-10: Botanical Resources

*T-10. What are the historic conditions, existing conditions and trend for botanical resources of concern in the watershed? What can be done to restore and maintain desired conditions?*

### 1. Characterization of the Botanical Resources (Step 1)

#### a. Landscape overview

##### 1) High Species Diversity

The Upper Illinois River watershed is an excellent representation of the Klamath-Siskiyou Mountains Ecoregion, long recognized for its plant diversity and very complex vegetation patterns. The complex geological processes have created a mosaic of parent materials. The presence of extensive deposits of ultramafic soils adds much to the complexity of vegetation patterns.

Another contributing factor to plant diversity for this Ecoregion is the placement between the California Floristic Province and the Pacific Northwest Province, resulting in species from these two regions at the limits of their range. Its' relative isolation from other mountain ranges and periods of aridity throughout its geologic history has left the Ecoregion harboring numerous relic species (paleoendemics). Paleoendemics are ancient species with very restricted habitats that once were more widespread. The Klamath-Siskiyou Ecoregion has the greatest concentration of species endemic to serpentine in western North America (Coleman and Kruckeberg 1999). Globally, the biodiversity of the Ecoregion has been ranked as outstanding among the world's temperate coniferous forest ecoregions (Della Sala et. al 1999).

The species diversity in this watershed is related to the diversity of the soils, and the plants adaptation to the effects of frequent fires.

##### 2) High Concentration of Rare Plants / Rare Plant Surveys

This watershed has long been visited by both amateur and professional botanists who have contributed sightings. None the less, a majority of the Upper Illinois River watershed has not been surveyed and a complete plant inventory has not been prepared for this watershed.

Approximately 35% of BLM lands which occupy the lower elevations of the watershed have been surveyed. However this represents only 3% of the total watershed. These surveys found 89 populations of sensitive species.

Six of the rarest species have had general surveys of their potential habitat and Draft Management Guides (Conservation Plans) completed. Additional populations will be discovered with more intensive surveys.

### b. Sensitive Plants

A wide variety of habitat conditions maintain the sensitive species presently occurring within the watershed. Many sensitive plant species are serpentine endemic found only on ultramafic soils. The watershed shows 18% ultramafic soils at the 2nd order scale soil surveys. Table T-21 lists species name, status, and habitat requirements for the rare plants (Federal C2 or higher, ONHP List 2, CNPS 1B or higher) documented in the watershed.

Table T-20: Habitat Requirements for Sensitive Plant Species in the Upper Illinois River Watershed, Oregon and California Lands (Federal C2 or higher, ONHP List 2, CNPS 1B or higher)

| Species | Status | Habitat Requirements |
|---|---|---|
| *Allium campanulatum*<br>Sierra onion | sensitive | Open, dry mountain slopes. Grizzly Peak and Indian Creek area. Coast Range mountains. Klamath Mountains. |
| *Arabis macdonaldiana*<br>*(inc. A. serpentinicola)*<br>McDonald's rock-cress | Endangered | On barren to shrub-covered, shallow, rocky, serpentine soils and Jeffrey pine woodlands . At 500-4,000 feet elevation. Red Mtn., Rough and Ready Creek, Josephine Creek, East Fork Illinois River. |
| *Arabis modesta*<br>Rogue Canyon rockcress | sensitive | Rocky walls, bluffs and damp banks or slopes at 500 to 1,500 feet elevation. Known from Rogue Canyon, Taylor Creek Gorge, Rough and Ready Creek and Klamath River. |
| *Arctostaphylos hispidula*<br>Howell's manzanita | sensitive | Dry rocky ridges and gravelly soils, often on serpentine. Shrub communities or sparse forest. Curry and Josephine Counties in Oregon and northwestern California. |
| *Arnica viscosa*<br>Shasta arnica | sensitive | Found on high elevation subalpine to alpine, open, talus slopes. Southern Oregon Cascades and Klamath Mountains. |
| *Aster vialis*<br>Wayside aster | sensitive | Is found in coniferous forests at elevations ranging from 500 feet to 5,100 feet. Typically occurs on relatively dry upland sites dominated by *Pseudotsuga menziesii*. |
| *Bensoniella oregana*<br>Bensonia | sensitive | Relatively deep soils in moist meadows, and along streamsides at 3,000 to 5,000 feet. Upper slope sites and ridge saddles with northerly aspects. Siskiyou National Forest and Humbolt County, California. |
| *Botrychium crenulatum*<br>Scalloped moonwort | sensitive | Moist grassy places on the margins of wetlands at higher elevations. In Oregon known from the Wallowa Mountains and scattered locations in a number of western states. |
| *Calochortus greenei*<br>Greene's mariposa lily | sensitive | Open, dry, sunny slopes on heavy clay, adobe soils. Also, areas with rocky surface texture, shallow soils profile and poorly developed humus layer at elevations ranging from 2,100 to 4,550 feet. |
| *Calochortus howellii*<br>Howell's mariposa lily | sensitive | Serpentine soils, dry rocky slopes. Low to middle elevations often on *Ceanothus* covered slopes or in open Jeffrey pine savannah. Endemic to the Illinois Valley. |
| *Calochortus umpquaensis*<br>Umpqua mariposa lily | sensitive | Serpentine soils, dry rocky slopes. Low to middle elevations often on *Ceanothus* covered slopes or in open Jeffrey pine savannah. Endemic to the Illinois Valley. |
| *Calochortus persistens*<br>Siskiyou mariposa lily | sensitive | Serpentine soils, dry rocky slopes. Low to middle elevations often on *Ceanothus* covered slopes or in open Jeffrey pine savannah. Endemic to the Illinois Valley. |
| *Camassia howellii*<br>Howell's camas | sensitive | Tends to grow on serpentine in open places, in heavy but not necessarily deep soil. Dry or vernally wet meadows. |
| *Camissonia graciliflora*<br>Slender-flowered evening primrose | sensitive | Open or shrubby slopes, generally clay soils, grasslands, oak woodlands at elevations below 2,600 feet. |
| *Cardamine nuttallii* var. *gemmata*<br>yellow-tubered toothwort | Species of Concern sensitive | Gravelly serpentine soils on ridges, Jeffrey pine forests, near *Darlingtonia* bogs. Grows on disturbed sites, in sunny and shaded areas. Siskiyou Mtns. of Josephine and Curry Cos. |
| *Carex gigas*<br>Siskiyou sedge | sensitive | Serpentine endemic. Vernally or perennially wet serpentine above 5,000 feet . Generally grows in open, sunny sites with little cover. Habitat often appears dry by flowering time. |
| *Carex interior*<br>Inland sedge | sensitive | Serpentine endemic. Vernally or perennially wet serpentine above 5,000 feet . Generally grows in open, sunny sites with little cover. Habitat often appears dry by flowering time. |
| *Carex livida*<br>Pale sedge | sensitive | Serpentine endemic. Vernally or perennially wet serpentine bogs at elevations ranging from 1,300 to 1,800 feet . Generally grows in open, sunny sites with little cover. Some of these wetlands dry out by mid summer. |

Table T-20: Habitat Requirements for Sensitive Plant Species in the Upper Illinois River Watershed, Oregon and California Lands (Federal C2 or higher, ONHP List 2, CNPS 1B or higher)

| Species | Status | Habitat Requirements |
|---|---|---|
| *Carex serratodens*<br>Saw-toothed sedge | sensitive | Calcareous seep in Douglas-fir forest. Josephine, Jackson, and Douglas Cos. |
| *Castilleja schzotricha*<br>Split-hair Indian paintbrush | sensitive | On decomposed granite or marble at elevations ranging from 5,000 to 6,000 feet on north aspects, red fir forests. In Oregon along the Siskiyou crest at Red Mtn., Dutchman Peak, Observation Peak, and Lake Peak. In California, located in Klamath Mtns. and the Red Buttes Wilderness. |
| *Chaenactis suffrutescens*<br>Shasta chaenactis | sensitive | Dry, open areas at elevations ranging from 2,400 to 6,500 feet. Klamath Range. |
| *Chlorogalum angustifolium*<br>Narrow-leaved amole | sensitive | Open, dry places, heavy soil in grasslands and woodlands at elevations below 1,500 feet. California inner coast ranges. In Oregon known from an area between Gold Hill and Central Point. |
| *Cimicifuga elata*<br>Tall bugbane | sensitive | In moist shady woods at elevations ranging from 4,300 to 5,400 feet. Moderate slopes and north to northeast facing. The forest canopy is 75%. *Abies concolor* is the dominant species with a sparse shrub layer of *Ribes* spp., *Rosa* sp., and *Rubus parviflorus*. |
| *Clarkia heterandra*<br>Small-fruit clarkia | sensitive | Shady sites, woodland, ponderosa pine stands at elevations ranging from 1,500 to 5,500 feet. |
| *Cupressus bakeri*<br>Baker's cypress | sensitive | Mixed-evergreen forests, dry, brushy or open slopes, flats, usually rocky ground, often on serpentine soils at elevations ranging from 3,800 to 6,000 feet. Klamath Range and Siskiyou Mtns. Nearest sites to forest Steve Peak and Miller Lake. |
| *Cypripedium fasciculatum*<br>Clustered lady's slipper | sensitive | Open coniferous forest, sometimes with Pacific dogwood on north facing slopes at elevations ranging from 1,000 to 6,000 feet. Elder Creek, Grayback Creek, Illinois River, Allen Gulch. |
| *Cypripedium montanum*<br>Mountain lady's slipper | sensitive | Moist areas, dry slopes. Mixed-evergreen, coniferous forest at elevations ranging from 300 to 7,000 feet. Waldo Mountain road, Elder Creek. |
| *Delphinium nudicaule*<br>Red larkspur | sensitive | Moist talus, wooded rocky slopes at elevations below 7,800 feet. Elder Creek. |
| *Dicentra pausiflora*<br>Few-flowered bleeding heart | sensitive | Rocky places at higher elevations. Youngs Peak. |
| *Draba carnosula*<br>Mt. Eddy draba | sensitive | On rock facing, rocky serpentine outcrops at higher elevations. |
| *Draba howellii*<br>Howell's whitlow-grass | sensitive | North-facing rock crevices, above 4,000 ft. In Oregon known from southern Josephine Co. and one site in Curry Co. |
| *Epilobium oreganum*<br>Oregon willow-herb | Species of Concern<br>sensitive | Wet, gently sloping stream banks, meadows, & bogs, generally on ultramafic soil. 1,500-7800 feet elev. Klamath Ranges of CA & OR. |
| *Epilobium siskiyouensis*<br>Siskiyou willow-herb | sensitive | North facing rock crevices and slopes on serpentine soils at elevations ranging from 5,500 to 8,200 feet |
| *Erigeron cervinus*<br>Siskiyou daisy | sensitive | Rocky places or crevices in solid rock. Streambanks; seeps/vernally wet sites. Meadows, pine and fir woods |
| *Erigeron petrophilus*<br>Cliff daisy | sensitive | Rocky places or crevices in solid rock. Streambanks; seeps/vernally wet sites. Meadows, pine and fir woods |
| *Eriogonum hirtellum*<br>Klamath Mtn. buckwheat | sensitive | Talus slopes and dry serpentine soils in open areas amidst Jeffrey pine - incense cedar and Brewers spruce - red fir forests at 2,000 to 5,500 feet elevation in Del Norte and Siskiyou Counties, Klamath Mtns. |
| *Eriogonum lobbii*<br>Lobb's buckwheat | sensitive | Gravelly ridges and talus slopes at moderate to high elevations. Not generally found on serpentine soils. Klamath Mtns. |
| *Erythronium hendersonii*<br>Henderson's fawn lily | sensitive | Dry woodlands, meadows, open fields at elevations ranging from 900 to 5,280 feet. Klamath Range. |
| *Erythronium howellii*<br>Howell's fawn lily | sensitive | In open woods, often on serpentine soils or in ecotonal areas. South end of Illinois Valley, Josephine Co., OR south to Trinity Mtns., CA. |
| *Eschcholzia caespitosa*<br>Slender California poppy | sensitive | Dry flats and brushy slopes below 3,500 feet elevation. |
| *Festuca elmeri* | sensitive | Generally in transition areas between oak woodland/grassland and Douglas-fir at elevations ranging |

Table T-20: Habitat Requirements for Sensitive Plant Species in the Upper Illinois River Watershed, Oregon and California Lands (Federal C2 or higher, ONHP List 2, CNPS 1B or higher)

| Species | Status | Habitat Requirements |
|---|---|---|
| Elmer's fescue | | from 2,350 to 4,350 feet. |
| *Frasera umpquaensis* Umpqua frasera | sensitive | Open woods or at edges of meadows. In mid to upper elevation true fir dominated forests or mixed conifer forests at 4,000 to 6,000 feet elevation, generally in partial shade or openings. |
| *Fritillaria glauca* Siskiyou fritillaria | sensitive | Gravelly serpentine slopes and ridges. Southern Douglas Co. south through the Siskiyou Mtns. of Josephine and Curry Cos. in OR. |
| *Fritillaria purdyi* Purdy's fritillaria | sensitive | Gravelly serpentine slopes and ridges. Inner north coast range of California and Josephine County, OR. |
| *Gentiana newberryi* var. *newberryi* Newberry's gentian | sensitive | Subalpine wet meadows between 3,500 to 6,500 feet elevation. Sanger Peak area and Red Buttes wilderness. |
| *Gentiana plurisetosa* Klamath gentian | sensitive | Wet mountain meadows between 3,900 to 6,200 feet elevation. Josephine Co. in Oregon to Del Norte, Siskiyou and Trinity Cos. in CA. |
| *Gentiana setigera* Waldo or Mendocino gentian | Species of Concern sensitive | Serpentine wet meadows and bogs, seeps on slopes at low elevations. Del Norte Co., CA. Siskiyou Mtns. OR. |
| *Hastingsia atropurpurea* Purple-flowered rush-lily | Species of Concern sensitive | Wet meadows, rocky seeps, serpentine *Darlingtonia* bogs at lower elevations, often in open areas on gentle slopes. Limited range in Josephine Co. |
| *Hastingsia bracteosa* large-flowered rush-lily | Species of Concern sensitive | Wet meadows, rocky seeps, serpentine *Darlingtonia* bogs at lower elevations, often in open areas on gentle slopes. Limited range in Josephine Co. |
| *Hazardia whitneyi* ssp. *discoidea* Whitney's haplopappus | sensitive | Dry brushy slopes on serpentine soils at any elevation. Klamath Mtns. in Coos, Curry and Josephine Cos. |
| *Horkelia hendersonii* Henderson's horkelia | sensitive | Grows on gravelly alpine scree on slopes and summit ridges principally from 6,000 to 7,500 feet elevation. The high elevation granitic-type rock substrate is limited in distribution. |
| *Iliamna bakeri* Baker's globe-mallow | sensitive | Mountain slopes at elevations ranging from 3,300 to 7,500 feet. |
| *Iliamna latibracteata* California globe-mallow | sensitive | Moist sites, streamsides in coniferous forests. Often on shady, disturbed ground at elevations ranging from 600 to 7,500 feet. Page Mountain. Douglas County Oregon to Humbolt County California. |
| *Lewisia cotyledon* var. *heckneri* Heckner's lewisia | Species of Concern sensitive | Granitic or serpentine rock outcrops, full sun or partial shade at 2,000-4,000 feet elevation. Kalmiopsis Wilderness and vicinity in Curry & Josephine Cos. |
| *Lewisia cotyledon* var. *purdyi* Purdy's lewisia | Species of Concern sensitive | Granitic or seprpentine rock outcrops, full sun or partial shade at 2,000-4,000 feet elevation. Kalmiopsis Wilderness and vicinity in Curry & Josephine Cos. |
| *Lewisia oppositifolia* Opposite-leaved lewisia | sensitive | Rocky, gravelly, moist areas on serpentine soils. Siskiyou Mtns. of southern Josephine & Douglas Cos. OR. Klamath Mtn. Ranges in California. |
| *Lewisia leana* Lee's lewisia | sensitive | Rock outcrops often on serpentine soils. Siskiyou Mtns. of southern Josephine & Douglas Cos. OR. |
| *Lilium kelloggii* Kellogg's lily | sensitive | Dry woods, gaps and roadsides in coniferous forests, redwood forests or brush fields below 3,500 feet elevation. Collier Tunnel. Del Norte and Humbolt Cos. in CA. and Curry Co. OR. |
| *Limnanthes gracilis* var. *gracilis* slender meadow-foam | Species of Concern sensitive | Sunny vernally wet meadows and stream edges, in valleys and low foothills, including serpentine soils, below 2,500 feet. Illinois Valley, Rogue River Valley of Josephine and Jackson Cos. |
| *Lomatium cookii* Agate desert-parsley | sensitive | Gravelly, serpentine slopes in coniferous forests and open areas at 3,000-6,000 feet elev. Siskiyou Mtns. and adjacent CA. |
| *Lomatium engelmannii* Englemann's desert-parsley | sensitive | Gravelly, serpentine slopes in coniferous forests and open areas at 3,000-6,000 feet elev. Siskiyou Mtns. and adjacent CA. |
| *Lomatium tracyi* Tracy's desert-parsley | sensitive | Open pine forests on serpentine at 1,500-4,500 feet elev. Siskiyou Mtns. |
| *Lotus stipularis* Stipuled trefoil | sensitive | Open pine forests, stream beds, ditches at elevations ranging from 600 to 4,000 feet. Klamath Range. |
| *Lupinus tracyi* Tracy's lupine | sensitive | Dry openings, edges of forest, or in open woods on granitic soils at moderate to high elevations. Often with the ground cover *Arctostaphylos nevadensis*. |

Table T-20: Habitat Requirements for Sensitive Plant Species in the Upper Illinois River Watershed, Oregon and California Lands (Federal C2 or higher, ONHP List 2, CNPS 1B or higher)

| Species | Status | Habitat Requirements |
|---|---|---|
| *Meconella oregana* White meconella | sensitive | Open ground and prairies on sandy, gravelly or serpentinized soil, often vernally moist. Some northern Oregon sites are adjacent to vernal seeps or slopes. |
| *Microseris howellii* Howell's microseri | Species of Concern sensitive | Found on slopes or flat ground with varying exposures, in rocky serpentine soils from 1,000- 3,500 feet elevation. Siskiyou Mtns. |
| *Mimulus tricolor* Three-colored mimulus | sensitive | Vernally moist depressions and clay soils at elevations below 2,000 feet. Historical sighting near Waldo by Al Hobart. |
| *Mimulus jepsonii* Jepson's monkeyflower | sensitive | Pine forest openings, generally granitic soils at elevations ranging from 3,600 to 7,200 feet. Layman Gulch and French Peak. |
| *Monardella purpurea* Siskiyou monardella | sensitive | Rocky, open slopes on ultramafic soils at 1,400-4,000 feet elev. Chaparral, woodland, montane forest. Curry and Josephine Cos. |
| *Montia howellii* Howell's montia | sensitive | Vernally wet sites, meadows at less than 1,200 feet elev. |
| *Pellaea mucronata* ssp. *mucronata* Bird's foot fern | sensitive | Rocky or dry areas at elevations ranging from 60 to 7,300 feet. |
| *Perideridia erythrorhiza* red-root yampah | Species of Concern sensitive | Vernally moist depressions in heavy poorly drained soils, below 5,000 feet elev. Josephine County sites on serpentine soils. Often grows in association with *P. oregana*. |
| *Phacelia greenei* Greene's phacelia | sensitive | Serpentine soils in coniferous forest at elevations ranging from 2,400 to 5,00 feet. Klamath Range. |
| *Phacelia leonis* Leo's phacelia | sensitive | Sandy flats, slopes, coniferous forest at elevations ranging from 3,600 to 6,600 feet. Klamath Range. |
| *Pilularia americana* American pillwort | sensitive | Vernal pools, mud flats,, lake margins, reservoirs. At less than 4,500 feet elevation. |
| *Pinguicula vulgaris* ssp. *macroseras* Horned buttewort | sensitive | Perennially wet seeps and bogs. Almost always in serpentine bogs in Oregon. Josephine and Curry Cos. in OR. Del Norte and Siskiyou Cos. in CA. |
| *Plagiobotrys figuratus ssp. corallicarpus* Coral seeded allocarpa | sensitive | Vernally moist, rocky, open areas in grassland meadows. |
| *Plagiobotrys glyptocarpus* Scultured allocarpa | sensitive | Moist places, grasslands, woodlands at elevation below 2,000 feet. |
| *Polystichum californicum* California shield-fern | sensitive | Woods, streambanks and canyons, to rocky open slopes in mixed evergreen forests. At elevations below 2,500 feet. |
| *Raillardella pringlei* Showy raillardella | sensitive | Bogs, fens, meadows (mesic), and streambanks at elevations ranging from 3,600 to 6,800 feet. Klamath Range. Trinity Alps, Scott Mountains. |
| *Sanicula tracyi* Tracy's sanicle | sensitive | Openings in coniferous forest, woodland at elevations ranging from 300 to 3,000 feet. Humboldt, Trinity and Del Norte Cos. in CA. |
| *Salix delnortensis* Del Norte willow | sensitive | Streambeds, streambanks, and gullies on serpentine soils. Habitat may be dry in summer. Low elevation up to 1,500 feet. |
| *Saxifragopsis fragarioides* Joint-leaved saxifrage | sensitive | Rock crevices at elevations ranging from 4,500 to 9,900 feet. Klamath Range. |
| *Scirpus pendulus* Drooping bullrush | sensitive | Marshes, wet meadows, and ditches at elevations ranging from 2,400 to 3,500 feet. |
| *Scirpus subterminalis* Water bullrush | sensitive | In quiet, relatively shallow water. Lakes, ponds, marshes. Del Nortem Humboldt and Plumas Cos. in CA. Whiskey Lake. |
| *Sedum laxum* ssp. *heckneri* Heckner's stonecrop | sensitive | Dry rocky places. Metasedimentary outcropings or serpentine soils at elevations ranging from 300 to 5,500 feet. |
| *Sedum moranii* Glandular stonecrop | sensitive | Dry rocky places. Metasedimentary outcropings or serpentine soils at elevations ranging from 300 to 5,500 feet. |
| *Senecio hesperius* Siskiyou butterweed | Species of Concern sensitive | Endemic to the Illinois Valley, found on serpentine soils at lower elevations, on gentle to moderate slopes. Generally in open Jeffrey pine savannah. |
| *Sidalcea malvaeflora* | sensitive | Open meadows or grassy places, at elevations below 2,500 feet. Coast Ranges. Del Norte and |

Table T-20: Habitat Requirements for Sensitive Plant Species in the Upper Illinois River Watershed, Oregon and California Lands (Federal C2 or higher, ONHP List 2, CNPS 1B or higher)

| Species | Status | Habitat Requirements |
|---|---|---|
| *ssp. patula*<br>Siskiyou checkerbloom | | Humboldt Cos.and sw Oregon. |
| *Silene hookeri ssp. bolanderi*<br>Bolander's catchfly | sensitive | Rocky knolls and slopes, often on serpentine soils at elevations below 5,000 feet. Josephine Co. OR and northwestern CA. |
| *Smilax jamesiii*<br>English Peak greenbriar | sensitive | Lakesides, streambanks, alder thickets in montane coniferous forests at elevations ranging from 3,000 tp 7,500 feet. |
| *Streptanthus howellii*<br>Howell's streptanthus | sensitive | Dry, rocky, serpentine slopes in open conifer/hardwood forest from 1,000 4,500 feet elevation. Del Norte Co., CA. Siskiyou Mountains, in OR. |
| *Tauschiai howellii*<br>Howell's tauschia | sensitive | Dry, exposed ridges in granitic gravel and serpentine flats in coniferous forests. At high elevation ranging from 6,600 to 7,100 feet. Siskiyou Mtns. |
| *Thermopsis robusta*<br>Robust false lupine | sensitive | Open places below 4,500 feet. Mixed evergreen forests, foothill woodland. Del Norte County. |
| *Thlaspi californicum*<br>Kneeland pennycress | | Serpentine outcrops at elevations ranging from 1,500 to 2,200 feet. |
| *Triteleia laxa*<br>Ithuriel's spear | sensitive | Sunny places at low elevations. Open forests, woodlands, and grasslands on clay soils. Southern Curry and Jackson Cos. in Oregon. |
| *Viola primulifolia* ssp. *occidentalis*<br>western bog violet | Species of Concern<br>sensitive | *Darlingtonia* bogs on serpentine soils at lower elevations. Del Norte Co., CA. Curry and Josephine Cos., OR. |
| *Wolfia borealis*<br>Dotted water-meal | sensitive | Fresh water at elevations below 3,400 feet. |
| *Woldia columbiana*<br>Columbia water-meal | sensitive | Free floating in quiet water at elevations below 700 feet. |

### c. Survey and Manage Species

Table T-21: Survey and Manage Vascular Plants, Lichens, Fungi and Bryophytes Known or Suspected to Occur in the Watershed.

| Species and Status | Habitat |
|---|---|
| ***Vascular Plants*** | |
| *Allotropa virgata*<br>Sugar stick | Old-growth forest; dry well drained soils. Appears substrate specific to decaying fir. Elevation 250 to 10,000 feet. Elder Creek, Layman Creek, Allen Gulch |
| *Eucephalus vialis*<br>Wayside aster | Coniferous forest at elevations ranging from 500 to 3150 feet. Occurs on dry upland sites dominated by *Pseudotsuga menziesii*, in canopy gaps and forest edges. Kingfish T.S. unit 5. |
| *Cypripedium fasciculatum*<br>Clustered lady's slipper | Old-growth forest; dry or damp, rocky to loamy sites; 60-100% shade. Elevation 1,300 to 7,300 feet. Elder Creek, Allen Gulch |
| *Cypripedium montanum*<br>Mountain lady's slipper | Old-growth forest; found on moist sites but may occur on dry sites in other parts of its range. Elevation 650 to 7,000 feet. Elder Creek. |
| *Pedicularis howellii*<br>Howell's lousewort | Dry ridges, open-red fir forests, at elevations ranging from 4,500 to 6,500 feet. Bearcamp Ridge. |
| ***Bryophytes*** | |
| *Buxbaumia viridis*<br>green bug moss<br>Protection Buffer | Occurs on rotten wood and on mineral or organic soil, in cool, shaded locations. Floodplains and stream terraces. Elevation 3,500 to 5,000 feet. |
| *Kurzia makinoana*<br>Liverwort<br>Survey and Manage | Especially moist low elevation stream terraces. In our forest 60 miles inland. Elevation 300 to 1,200 feet. |
| *Ptilidium californicum*<br>Pacific fuzzwort<br>Survey and Manage | Grows on conifer bark and logs, requiring cool, moist conditions. Has been found on Brewer spruce and Chinquapin in our forest at elevations ranging from 3,000 to 6,000 feet. |
| ***Moss*** | |

| Table T-21: Survey and Manage Vascular Plants, Lichens, Fungi and Bryophytes Known or Suspected to Occur in the Watershed. | |
|---|---|
| **Species and Status** | **Habitat** |
| *Rhizomnium nudum*<br>Protection Buffer | On moist but not wet organic soils, sometimes among rocks or rotten logs, sometimes along streams, mostly in middle to high elevation forests. |
| *Tetraphis geniculata*<br>Protection Buffer | Occurs on rotten wood, prefers the cut end of old-growth logs, in cool, humid, shaded locations at low to middle elevations. A closed canopy provides the best micro climate. |
| *Ulota megalospora*<br>Protection Buffer | Grows on twigs and branches at low to middle elevations, 150 to 200 feet in the canopy, occurs most frequently on *Alnus rubra*. |
| ***Lichens*** | |
| *Bryoria tortuosa*<br>Survey and Manage | Mostly on trees and shrubs but a few species occur on rock, soil and under water. |
| ***Fungi*** | |
| *Aleuria rhenana*<br>Protection Buffer | Accumulated duff and humus in low to mid elevation mixed conifer or conifer-hardwood forests. |
| *Bridgeoporus nobilissimus*<br>Noble polypore<br>S & M and ext. survey | Pacific silver fir zone including *Abies amabilis, A. procera,* and possible *Pseudotsuga menziesii.* |
| *Bondarzewia montana*<br>Survey and Manage | Late-Successional conifer forests, often associated with stumps or snags. |
| *Otidea leporina*<br>Protection Buffer | Conifer duff |
| *Otidea onotica*<br>Protection Buffer | Conifer duff. Occurring in Josephine county. |
| *Otidea smithii*<br>Protection Buffer | Conifer duff. |
| *Sarcosoma mexicana*<br>Protection Buffer | Dead conifer litter. |

### d. Noxious Weeds and Exotic Plants

Complete field surveys for noxious and exotic plants have not been conducted in the watershed but those past surveys that have been completed have shown several species of noxious weeds and common exotics presen. Table T-22 lists those that have been found.

| Table T-22: Noxious Weeds | |
|---|---|
| **Species** | **Habitat** |
| *Bromus tectorum* | cheat grass Disturbed areas. |
| *Centaurea sp.*<br>Knapweed | Disturbed areas, meadows, roadsides. |
| *Centaurea solstitialis*<br>yellow star-thistle | Disturbed areas, alongside roads, river corridor. |
| *Circium vulgare*<br>bull thistle | Every road, landing seems to have at least one plant. |
| *Cystisus scoparious*<br>Scotch broom | Old homesteads, mining areas, along roadsides, some campgrounds. |
| *Elytrigia intermedia*<br>intermediate wheat grass | Introduced grass for revegetation purpose. |
| *Holcus lanatum*<br>velvet grass | Introduced grass for feed and revegetation purpose. |
| *Isatis tinctoria* | Happy Camp Road. Disturbed areas. Spread by contaminated maintenance equipment. |

| | |
|---|---|
| Dyer's woooad | |
| *Lathyrus latifolius*<br>everlasting peavine | Has invaded seeps, springs, meadows, and streams around culverts. |
| *Hypericum perforatum*<br>Klamath weed | Along roads, landings, meadows, skid trails and plantations. |
| *Rubus discolor*<br>Himalayan blackberry | Patches along roadsides, disturbed areas, homesteads, seeds carried by birds. |
| *Taraxacum officinale*<br>dandelion | Meadows, a few scattered plants. |
| *Trifolium repens*<br>white clover | Introduced wildlife species to improve habitat. |
| *Verbascum thapsus*<br>mullein | Introduced with cattle feed, spread to plantations. Has become an important wildlife food source. |

### e. Watch and Review Species (ONHP list 3 & 4 and CNPS list 3 & 4)

| Table T-23: Watch and Review Species | |
|---|---|
| **O.N.H.P. List 3** | |
| *Adiantum jordanii* | California maiden-hair |
| *Ammania robusta* | Ammannia |
| *Asarum caudatum* | White-flowered wild-ginger |
| *Aster brickellioides* | Brickellbush; rayless leafy aster |
| *Astragalus gambelianus* | Blackish milk-vetch |
| *Brodiaea californica* | California brodiaea |
| *Callitriche marginata* | Winged water starwort |
| *Cardamine nuttallii* var. *dissecta* | Dissected toothwort |
| *Cardamine nuttallii* var. *covilleana* | Coville's toothwort |
| *Carex barbarae* | Santa Barbara sedge |
| *Carex serpentinicola* | Serpentine sedge |
| *Epilobium luteum* | Yellow willow-herb |
| *Helianthus bolanderi* | Bolander's sunflower |
| *Hieracium greenei* | Greene's hawkweed |
| *Juncus kelloggii* | Kellogg's rush |
| *Leucothoe davisii* | Sierra laurel |
| *Linanthus bakeri* | Baker's linanthus |
| *Mertensia bella* | Oregon bluebells |
| *Navarretia leucocephala* | White-flowered navarretia |
| *Navarretia tagetina* | Marigold navarretia |
| *Poa rhizomata* | Timber bluegrass |
| *Ribes divaricatum* var. *pubiflorum* | Straggly gooseberry |
| *Silene californica* | California pink |
| *Silene lemmonii* | Lemmon's campion |
| *Streptanthus glandulosus* | Common jewel flower |
| *Triteleia ixioides* ssp. *scabra* | Foothill pretty face |
| **O.N.H.P. LIST 4** | |
| *Arabis aculeolata* | Waldo rock-cress |
| *Arabis koehleri* var. *stipitata* | Koehler's rock-cress |
| *Balsamorhiza sericea* | Silky balsamroot |
| *Cardamine nuttallii* var. *gemmata* | Purple toothwort |
| *Cypripedium californicum* | California ladyslipper |
| *Cypripedium montanum* | Mountain ladyslipper |
| *Darlingtonia californica* | California pitcher plant |
| *Dicentra formosa* ssp. *oregana* | Oregon bleeding heart |
| *Dichelostemma ida-maia* | Firecracker brodiaea |
| *Eriogonum pendulum* | Long-stalked eriogonum |
| *Euonymus occidentalis* | Western wahoo |
| *Hieracium bolanderi* | Bolander's hawkweed |

| | |
|---|---|
| *Kalmiopsis leachiana* | Kalmiopsis |
| *Lewisia oppositifolia* | Opposite-leaved lewisia |
| *Mimulus douglasii* | Douglas's monkeyflower |
| *Mimulus kelloggii* | Kellogg's monkeyflower |
| *Minuartia californica* | California sandwort |
| *Montia diffusa* | Branching montia |
| *Phacelia verna* | Spring phacelia |
| *Poa piperi* | Piper's bluegrass |
| *Polystichum lemmoni* | Lemmon's sword fern |
| *Sanicula peckiana* | Peck's snakeroot |
| *Scribneria bolanderi* | Scribner's grass |
| *Sedum spathulifolium* ssp. *purdyi* | Purdy's stonecrop |
| *Smilax californica* | California smilax |
| *Thlaspi montanum* var. *siskiyouense* | Siskiyou Mountain pennycress |
| *Triteleia crocea* var. *crocea* | Yellow brodiaea |
| *Vancouveria chrysantha* | Yellow vancouveria |

**Table T-24: Rare Plants Lists for Illinois Valley Ranger District -** California Lands (6/99)

Based on: Region 5 Sensitive Species List - Revised 1998. U.S. Forest Service, 1998.
Inventory of Rare and Endangered Plants of California. California Native Plant Soc. 1994.

| ***Scientific Name*** | **Common Name** |
|---|---|
| **CNPS LIST 2** | |
| *Arabis aculeolata* | Waldo rock-cress |
| *Asarum marmoratum* | marbled wild-ginger |
| *Asplenium trichomanes* ssp. *trichomanes* | Maidenhair spleenwort |
| *Boschniakia hookeri* | Small groundcone |
| *Carex leptalea* | Flaccid sedge |
| *Carex practicola* | Meadow sedge |
| *Castilleja miniata* ssp. *elata* | Siskiyou indian paintbrush |
| *Erigeron bloomeri* var. *nudatus* | Waldo daisy |
| *Eriogonum nudum* var. *paralinum* | Del Norte buckwheat |
| *Horkelia congesta* ssp. *nemorosa* | Josephine horkelia |
| *Lomatium martindalei* | Coast Range lomatium |
| *Monotropa uniflora* | Indian pipe |
| *Rubus nivalis* | Snow dwarf bramble |
| *Scirpus subterminalis* | |
| **CNPS LIST 3** | |
| *Galium oreganum* | Oregon bedstraw |
| *Selaginella densa* var. *scopulorum* | Rocky Mountain spike-moss |
| **CNPS LIST 4** | |
| *Allium siskiyouense* | Siskiyou onion |
| *Antennaria suffrutescens* | Evergreen everlasting |
| *Arctostaphylos hispidula* | Howell's manzanita |
| *Arctostaphylos nortensis* | Del Norte manzanita |
| *Arnica cernua* | Serpentine arnica |
| *Arnica spathulata* | Klamath arnica |
| *Calamagrostis foliosa* | Leafy reed grass |
| *Carex gigas* | Siskiyou sedge |
| *Castilleja hispida* ssp. *brevilobata* | Short-lobed Indian paintbrush |
| *Collomia tracyi* | Tracy's collomia |
| *Cupressus nootkaensis* | Alaska cedar |

| | |
|---|---|
| *Cypripedium californicum* | California ladyslipper |
| *Darlingtonia californica* | California pitcher plant |
| *Dicentra formosa* ssp. *oregana* | Oregon bleeding heart |
| *Epilobium rigidum* | Siskiyou Mtns. willowherb |
| *Erigeron cervinus* | Siskiyou daisy |
| *Eriogonum ternatum* | Ternate buckwheat |
| *Erythronium citrinum* var. *citrinum* | Lemon-colored fawn lily |
| *Erythronium howellii* | Howell's fawn lily |
| *Gentiana plurisetosa* | Klamath gentian |
| *Horkelia sericata* | Howell's horkelia |
| *Iliamna latibracteata* | California globe mallow |
| *Iris bracteata* | Siskiyou iris |
| *Iris innominata* | Del Norte County iris |
| *Lathyrus delnorticus* | Del Norte pea |
| *Lilium bolanderi* | Bolander's lily |
| *Lilium kelloggii* | Kellogg's lily |
| *Lilium pardalinum* ssp. *vollmeri* | Vollmer's lily |
| *Lilium pardalinum* ssp. *wigginsii* | Wiggin's lily |
| *Lilium rubescens* | Redwood lily |
| *Lilium washingtonianum* ssp. *purpurascens* | Purple-flowered Washington lily |
| *Listera cordata* | Heart-leaved twayblade |
| *Lomatium howellii* | Howell's lomatium |
| *Lupinus lapidicola* | Mt. Eddy lupine |
| *Lupinus tracyi* | Tracy's lupine |
| *Lycopus uniflorus* | Northern bugleweed |
| *Melica spectabilis* | Purple onion grass |
| *Minuartia howellii* | Howell's sandwort |
| *Perideridia gairdneri* ssp. *gairdneri* | Gairdner's yampah |
| *Piperia candida* | White-flowered rein orchid |
| *Pityopus californicum* | California pinefoot |
| *Pleuropogon refractus* | Nodding semaphore grass |
| *Poa piperi* | Piper's bluegrass |
| *Poa rhizomata* | Timber blue grass |
| *Pyrrocoma racemosa* var. *congesta* | Del Norte pyrrocoma |
| *Salix delnortensis* | Del Norte willow |
| *Sanicula peckiana* | Peck's snakeroot |
| *Saxifraga howellii* | Howell's saxifrage |
| *Sedum laxum ssp flavidum* | Pale yellow stonecrop |
| *Sedum laxum* ssp. *hecknerii* | Heckner's stonecrop |
| *Senecio macounii* | Siskiyou Mtns. ragwort |
| *Tauschia glauca* | Glaucous tauschia |
| *Thermopsis gracilis* | Slender false lupine |
| *Trifolium howellii* | Howell's clover |
| *Triteleia crocea* var. *crocea* | Yellow triteleia |
| *Vancouveria chrysantha* | Yellow vancouveria |
| *Veratrum insolitum* | Siskiyou false-hellebore |

f. Unique Plants Communities and Key Indicator Species

1) Ultramafic

The Soil Survey map of the East Fork Illinois watershed shows large areas of ultramafic soils. The watershed has two types of key habitats in this soil type: wet and dry serpentine that may be suitable habitats for several species on the sensitive plants list as well as species endemic to the watershed. The key indicator species for serpentine savannah are: Waldo, Rogue Canyon and McDonald's rock-cress, purple toothwort, Bloomer's daisy, Engelmann's desert-parsley, rigid willow-herb, Siskiyou fritillaria, Howell's camas, Howell's fawn-lily, Howell's microseris, Howell's mariposa lily, Howell's streptanthus, Peck's snake root, Purdy's lewisia, Siskiyou butterweed, Siskiyou monardella, Howell's mariposa lily, Umpqua mariposa lily, yellow-tubered toothwort, and Bolander's hawkweed.

The key indicator species for serpentine wetlands are: Oregon willow herb, Waldo gentian, *Darlingtonia californica*, Del Norte willow, large-flowered rush lily, Inland sedge, Pale sedge, Siskiyou sedge, and western bog violet. Ephemerally wet serpentine soils can also harbor such species as opposite leaved lewisia and slender meadow foam. These species all inhabit ultramafic sites, which have soil mineral imbalances that prevent dense sites from growing; therefore the plants are found in forest openings or even barrens.

Both wet and dry serpentine areas are sometimes incidentally disturbed or destroyed by road building, skid trails, mining, recreational vehicles or side effects from these activities. Although portions of the project area has been impacted by past activities, most of the suitable ultramafic habitat for serpentine endemic plants is intact or, if disturbed, is still within the tolerance limits of the species of concern.

2) Riparian Habitats

Riparian habitats throughout the watershed may be suitable habitat for Bensonia, slender paintbrush, California greenbriar, California lady's slipper, California globe mallow, clustered lady's slipper, Del Norte willow, Oregon willow-herb, slender meadow-foam, scalloped moonwort, Cook's desert-parsley, Siskiyou daisy, and western bog violet. Perennial riparian habitat is abundant in the watershed in the form of rivers, streams, spring-fed seeps, meadows, and valley bottom grasslands. Riparian habitats have also been disturbed through mining, skid trails, and recreational vehicle use.

3) Rock Outcrops

Dry serpentine/non-serpentine rock outcrops are common throughout the watershed and appear to be suitable habitat for few-flowered bleeding heart, Howell's whitlow-grass, McDonald's rock-cress, Howell's manzanita, Howell's mariposa lily, Englemann's dessert-parsley, Howell's microseris, Siskiyou monardella, Howell's streptanthus, and Heckner's stonecrop.

Moist rock outcrops are suitable habitat for opposite-leaved lewisia, Siskiyou daisy, joint-leaved saxifrage, and Lee's lewisia. Some rock outcrops have been affected by road building, mining, and other past disturbances. A few may have been used as rock sources for road material.

#### 4) Forested Habitats: Old-Growth and Mature Forest

The watershed has areas that have been logged in the past. The area has changed from its historic state and includes the effects from timber harvesting, mining and fire suppression. Most of the impacts are related to mining, timber harvesting, recreation and road building for timber harvesting and mining purposes. Purple toothwort, clustered lady's slipper, Mountain lady's slipper, Howell's manzanita, Tracy's lupine, and wayside aster prefer forested habitat. This habitat type although not pristine is still well distributed and plentiful throughout the watershed.

### g. Recognition of Outstanding Resource Value

Research by master and PhD candidates
Published papers
High number of visitors viewing botanical resources, local and regional media articles on significance of area.
The recently published Conservation Plan for the Klamath-Siskiyou Ecoregion culminates a large effort to bring the Ecoregion to the forefront of national conservation efforts.

### h. Special Land Allocations: Botanical and Research Natural Areas

Approximately 1,962 acres of BLM administered lands are designated in the RMP as a part of the Illinois Valley Botanical Emphasis Area. This designation recognizes the exceptionally high representation of sensitive plants. The RMP states that actions including timber harvest will be allowed if they do not conflict with the habitat needs of these species. As stated above, the habitat quality of many sensitive species in the watershed is unknown.

The 656 acre French Flat Area of Critical Environmental Concern (ACEC) is located on BLM land. The area encompasses the best remaining examples of the full array of valley bottom plant communities. These communities include tufted hairgrass-California oat grass wet meadow, ponderosa pine-white oak/wedgeleaf savanna, ponderosa pine-black oak-madrone woodland, Jeffrey pine-manzanita-bunchgrass savanna and low elevation mixed conifer forest. The site supports one federal candidate species, Cook's desert parsley, and several sensitive species including Howell's microseris, Howell's mariposa lily, Siskiyou butterweed, slender meadowfoam, Howell's fawn lily, and opposite leaved lewisia. Currently, the main management issue for French Flat ACEC is indiscriminate recreational vehicle activity in the area. The BLM officially closed the road into French Flat through the Federal Register in 1992. Gating and fencing has since been installed, however four wheel vehicles continue to breach the closures leaving portions of the ACEC heavily damaged.

Approximately 400 acres on BLM administered and 25 acres of National Forest lands have been identified as having the potential for Research Natural Area (RNA) recognition. This area is in the vicinity of Allen Gulch and extends west towards the Waldo Hill lookout. This RNA encompasses both unique forested and serpentine habitats. The forested portion consists primarily of the Late-Successional tanoak-Douglas-fir-canyon live oak/poison oak plant community. It is characterized by large diameter tanoak, although is not the only form of tanoak present. Sensitive species as clustered lady's slipper, mountain lady's slipper, and Howell's fawn lily occur in forested portions. Also the

Survey and Manage, candystick, occur in numerous populations there.

The serpentine portion of the potential RNA combines wet and dry serpentine habitats. The wet serpentine area has not been adequately described to plant association level. It encompasses a unique combination of shrub and herbaceous species not found in other portions of the watershed. Current issues in this area include mining and potential thinning activities.

i. Important Processes

Geology - important consideration with, weed eradication, road revegetation, road maintenance, road decommissioning, and development.

Fire - needed for habitat improvement and to decrease overcrowding by more aggressive species and duff accumulation.

Rare pollinators - Data Gap, very little information known. Study on pollinators is underway at several sites in the forest.

Water table - Data Gap, ideal level of water table needed for optimum habitat quality on Darlingtonia fens is unknown.

Habitat requirements - Data Gap, detailed habitat requirements for many rare or sensitive plant species are unknown.

j. Species Management Guides/Conservation Plans (drafts only)

Table T-25 lists the 6 species with completed Forest Service draft Species Management Plans. Finalization is needed for all listed species. Species Management Guides provide biological information and management recommendations. The biological information commonly includes plant description, taxonomy, distinguishing characteristics, range and distribution (with maps), population biology, habitat description, and threats (natural and human related). The management section often gives status review, population objectives, monitoring needs, recommendations for maintaining species viability, sometimes designating "selected" populations.

Table T-25: Species Management Guides/Conservation Plans

| Species | Author(s)/Organization | Year Written |
|---|---|---|
| *Arabis macdonaldiana* MaDonald's rock-cress | A recovery plan for the California populations was developed. Contracted: John W. Willoughby. | 1984 |
| *Cardamine nuttallii var. gemmata* Purple toothwort | Peter Zika, Oregon Natural Heritage Program | 1994 |
| *Epilobium oreganum* Oregon willow-herb | James Kagan, Oregon Natural Heritage Program | 1994 |
| *Lomatium cookii* Cook's desert parsley | Jamas Kagan, Oregon Natural Heritage Program | 1994 |
| *Microseris howellii* Howell's microseris | James Kagan, Oregon Natural Heritage Program | 1988 |
| *Monardella purpurea* Siskiyou monardella | James Kagan, Oregon Natural Heritage Program | 1994 |
| *Pedicularis howellii* Howell's lousewort | Barbara Williams, Klamath National Forest | 1999 |

A conservation Agreement for serpentine fen species is currently being reviewed by both the Forest Service and BLM. The Agreement is a cooperative effort between these agencies and the Fish and Wildlife Service. It recommends conservation and management measures for several sensitive species including Waldo gentian, large flowered rush lily, western bog violet and Oregon willow-herb. The Agreement is meant to ensure that these species do not become listed in the future. A conservation strategy for these could be developed at the same time. The Conservation Strategy will lay the guidelines for management and monitoring of these species at a more detailed level.

## 2. Identification of Issues and Key Questions (Step 2)

### a. Concerns Related to Botany

The following questions and statements frame the most important botanical concerns in the watershed:

- What vascular plant species presently occur in the East Fork Illinois Watershed?

- What non-vascular plant species, such as lichens, bryophytes, and fungi occur in the East Fork Illinois Watershed?

- What is the floristic richness of the analysis area?

- Maintaining species viability, especially for species with very limited ranges. For land disturbing activities and minerals development consider cumulative effects and timely floristic surveys.

- What are the effects of fuels accumulation, fire frequency or lack of fire activity on rare plants?

- The lack of biological and habitat requirement information for most rare plants species (data gap)

- Development in unique habitats (buildings, water withdrawal, farming) especially along the river corridor.

- Off-highway vehicles are having serious impacts to *Darlingtonia* bogs, meadows, and riparian areas. Because rare plants occur throughout serpentine habitats, any off-road use is a concern. Serpentine soils are shallow and easily impacted with damage lasting decades or more.

- What Noxious Weeds and other non-native species - including non-native grasses - exist in the watershed? (data gap)

- Revegetation of serpentine soils after human-related disturbances and habitat restoration.

- What are the culturally-significant plants in the watershed? Are any of them at risk because of management activities or because of lack of management activities? Are any of these species limited in abundance?

- Revegetation with native species is key to maintaining a healthy relationship with soil micro organisms. At present there are sufficient quantities of native seeds to revegetate any soil disturbance in this watershed.

### 3. Description of Current and Reference Conditions (Steps 3 & 4)

The current conditions on federal lands in the East Fork Illinois watershed reflect a history of multiple use including mining, recreation, timber harvest and botanical collecting. To determine conditions and effects of past projects on current sensitive and endemic plants and their habitats is at best an educated guess. In some locations on BLM lands, the hydraulic mining of the 1930s completely obliterated some serpentine areas. Mining tailings are still present where vegetation has not reestablished to the level of adjacent non-mined areas.

Effects to plants and suitable habitat include soil disturbance that may render the habitat unsuitable for the rare plants. Depending on the degree of disturbance and the species in question, soil disturbance can have both positive and negative effects. Light disturbance may favor seedling establishment in openings on favorable soils; several seed bearing species should be able to colonize these openings unless out competed by weeds or unless the soil is repeatedly disturbed. Heavy soil disturbance, especially churning and compaction, is incompatible with maintenance of suitable habitat for rare plants as they will neither survive nor colonize churned up or compacted soils. Road beds and stream sides will revegetate over time if left undisturbed for long periods. Soil disturbance also disrupts mycorrhizal relationships which are considered important to plant survival in serpentine environments (Jimerson 1995).

Soil disturbance also invites weed infestation, especially in areas along roads where weed seeds can be easily brought in on vehicles and equipment. Once established, weeds can out compete native plants and prevent restoration of native vegetation on the site. There are several areas that show the presence of weeds.

Wet areas that may provide habitat for water loving plants are protected by standard project design criteria protecting perennial water or spring-fed seeps. However, localized short term adverse effects on riparian habitats may occur when the riparian areas are impacted by OHV and when rehabilitated, especially along the road segments.

Other effects on sensitive plants and their habitats could occur from timber harvests. Habitat requirements for survey and manage vascular plants, non-vascular plants, and fungi, in general, include Late-successional forest conditions where canopies are relatively closed. For example, a management recommendation for clustered lady's slipper is to maintain canopy closure at 60% or greater. Other recommendations include managing population sites to include areas large enough for maintenance of microclimates to conserve down woody debris and the duff layer and mycorrhyzal associations. To accomplish this active management will be necessary because these conditions are more dense than the reference conditions.

Fire exclusion and related impacts are discussed by most ecologists and scientists. The fire regime is a main component of successional processes. The natural fire return interval in the Jeffrey pine series was between 10 and 80 years with an average of 14 (See Table T-9). Fire suppression has increased the fuel loads which in turn may result in higher fire intensity and greater size burns. Any reintroduction of fire will have to consider these factors as well as the biology of the rare plants. Burning after the reproductive cycle has been completed is recommended. Monitoring the response of the rare plant species would be critical to their management. It will be critical to note which species do not respond to fire. Monitoring of the Cedar Log prescribed fire indicate that *Senecio hesperius* did not respond favorably. *Calochortus howellii* did not bloom after an area was burned at too close intervals in the Canyon Creek prescribed burn. However, Borgias and Beigel (1996) observed that the dominant species of serpentine savannas regenerated readily after wildfire.

### 4. Synthesis and Interpretation (Step 5)

In general vegetation growth, and encroachment, has occurred on serpentine rare plant habitat probably at a slower rates than other areas with better soils for more common plants. Wet meadows, wetlands, springs and riparian areas water table most probably has been affected by vegetation encroachment. Jimerson et. al. (1995) noted that in general, the diversity and cover of rare species appears to decline in serpentine environments where tree and shrub cover values are high.

Mining activities have changed the habitat along the river terraces and riparian areas and low elevation serpentine flats. Active restoration will be necessary if some of these areas (especially savannah habitats) are to be returned to historic vegetation communities.

Recreation activities have impacted unique habitats. Interpretation, public education, and restoration of the most used areas would help increase the enjoyment that people are seeking from these environments.

Fire suppression has decreased the size of meadows, serpentine savannas and openings in forested habitats. Prescribed burning could be used to reduce this encroachment. Fire suppression has increased canopy closure and layering which is to the benefit of some types of late seral dependant species.

Revegetation with non-native seed mixes has probably decreased the quality of the habitats for rare and native species. Efforts to research restoration of these areas could help to improve these habitats.

### 5. Data Gaps

• Sensitive plants population site conditions have not been assessed since first reported.

• Habitat quality for these sensitive species is unknown.

• To date, surveys for bryophytes, lichens and fungi have been completed on <5 % of NFS lands. Non-vascular plant surveys on BLM lands were begun in 2000.

• Noxious weed inventory - intensity of invasion.

• Lack of biological and habitat requirement information for most rare plants species.

• Draft Species Management Guides need to be updated and finalized.

### 6. Summary of Botany Recommendations (Step 6)

Noxious weeds: Eradication of some weeds will involve removal of those weeds and revegetation of those same sites. Priority locations include the Happy Camp/Waldo Road Highway corridor, especially the areas infected with knapweed, wild sweet peas, Dyers woad, and the scotch broom along several of the main roads in the valley.

Map weeds as projects are implemented to avoid weed competition and to diminish the threat to sensitive plant populations in the future in this area.

Revegetate along road corridors and around parking areas with native blooming wildflowers, as these areas are rehabilitated. Collect seed from local species. Work with local nurseries to provide native, genetically similar shrub species for restoration purposes.

Ultramafic soils areas have an excess of small to midsized shrubs and trees. Burn these areas to decrease these vegetation types and decrease the dead and accumulated duff. Burn in pockets or strips to create a mosaic pattern.

Maintain or increase large woody material levels to meet management recommendations for survey and manage bryophytes, lichens and fungi.

Maintain canopy cover in forested habitats consistent with the management recommendations for survey and manage vascular plants, bryophytes, lichens, and fungi.

Maintain openings in forested habitats to benefit California globe mallow, wayside aster, and McDonald's rockcress.

Forest Products: Identify key habitats and possible conflicts with rare plants, minimize impacts by avoiding these areas or limiting harvest amounts.

Avoid burning known sites of sensitive plants during prescribed or natural fire. Burn around population areas under very controlled, experimental conditions. Monitor results.

Research and develop effective restoration strategies for past mining areas, especially where tailings are present where it is necessary to revegetate these areas.

In places such as French Flat ACEC expand protection efforts to stop recreational vehicle trespassers.

Pursue evaluation of an RNA designation for those areas identified has having the potential for such a designation (BLM and FS lands).

## K. Key Question T-ll: Potential Conflicts between Recommendations

*T-11.What and where are the conflicts between various resources in terms of treatment recommendations? How can recommendation conflicts be mitigated or minimized?*

| Table T-26: Potential Conflicts Between Recommendations | |
|---|---|
| Conflicts between Treatment Recommendations | How Conflicts may be Mitigated or Minimized |
| Decommissioning roads to improve water quality could create conflicts (at some locations) with recommendations to reduce stand densities and manage fire (prescribed and wild fire). The primary reason for this conflict is economics, *i.e.*, mechanical thinning of small trees with limited commercial value requires road access to facilitate treatments that are economically viable, and some roads are needed for effective fire management. | - Stand density treatments: May include multiple thinning treatments and prescribed fire, especially in areas where higher canopy retention is desired, such as in Riparian Reserves where shade for streams is important to improving water temperature.<br>- Mechanical treatment of trees with small economic value: reduce stand densities before eliminating road access, especially in LSR and Riparian Reserves. Thin to a wide spacing, which facilitates rapid growth to a size that would contribute to the most rapid development of old growth forest habitat possible.<br>- Treat roads to minimize adverse affects to water quality and aquatic habitats until the road can be eliminated. Mechanical treatment of trees with no economic value; road access reduces the cost of treatment, but not significantly so road access is not required. Thin to a wide spacing.<br>- Prescribed and wildfire management; identify roads that are critical to success and treat these roads to minimize their adverse affects on water quality and aquatic habitats. |
| The goal of the Siskiyou Forest Plan is to maintain 20% of the area in pioneer seral/seed-sap-pole habitat for deer and elk is in conflict with land allocations in the watershed. Deer and elk (species associated with this habitat) are indicator species for other species associated with grass, forb, and shrub habitats. Only 14% of National Forest land is Matrix, and only about 10% of this is expected to be young openings with forage over time (assuming regeneration harvest when stands are 120 years old and successful fire exclusion). Therefore, based on land allocations, only 1% of National Forest land would be forage over the long term.<br>On BLM, area control of 1/3 in each of early, mid and late seral stages. | ·Improve the conditions for forage plants in small, mature, and old growth forest habitat by reducing stand densities and prescribed under-burning. |
| Recommendations in the Siskiyou Forest Plan to retain a minimum of 40% soil duff and litter (Standard and Guideline 7-4, pg. IV-44, 1989) may be a conflict with recommendations to under-burn and to burn hot enough to create suitable conditions for high quality forage. Essentially, soil duff and litter retention recommends low amounts of exposed mineral soil and conditions for high quality forage may require higher amounts of exposed mineral soil. | Research the source of this S&G; (i.e., Regional Guidelines), and confirm whether it is directed at prescribed fires in regeneration harvest areas or prescribed fires in all areas. Also, describe historic range of variability for soil duff and litter distribution and abundance prior to effective fire suppression. These are *DATA GAPs*. |

Table T-26: Potential Conflicts Between Recommendations

| Conflicts between Treatment Recommendations | How Conflicts may be Mitigated or Minimized |
|---|---|
| Recommendations to restore the distribution of mature and old growth forest habitat to reference conditions could be in conflict with the distribution of Late-Successional Reserve land allocations; i.e., the distribution of LSRs may not reflect historic distribution of mature and old growth forest habitat. | Historically, the distribution of mature and old growth habitat was patchier than the distribution of Late-Successional Reserves in the watershed. If mature and old growth habitat is restored in the entire area of these reserves, the distribution of mature and old growth may not be within the range of historic variation. Maintaining mature and old growth on dry aspects within Late-Successional Reserves may be difficult or impossible. In the short-term, retain mature and old growth habitat on federal lands as long as possible while meeting local community needs for forest commodities (e.g., timber from commercial thinning). |
| The recommendation to maintain old growth size trees; (>32" dbh) conflicts with timber management objectives in Matrix, and it may be in conflict with the restoration of giant (>45" dbh) trees in the watershed. | Although part of the definition for old growth forest includes trees greater than 32" dbh, trees larger than this are important to species that need large trees for nesting or denning; e.g., northern spotted owl and fisher (*Martes pennanti*). Impacts to species associated with large trees could be reduced if trees larger than 45" dbh are reserved from harvest until old growth has been restored within the historic range of variability in the watershed or the LSR and Riparian Reserve network is fully functioning. In some situations, the stand density of trees around 32" dbh. may need to be reduced to promote the development of trees over 45" dbh. Emphasize restoration in Riparian Reserves and Late-Successional Reserves and within plant series' with greater productivity (e.g., tanoak). |
| Meadow and pine/oak savanna recommendations may conflict with recommendations to restore Late-Successional Reserves and Riparian Reserves; e.g., restoration of old growth, maintenance of mature, and maintenance of all shade (in Riparian Reserves). | The Southwestern Oregon Late-Successional Reserve Assessment supports restoration and maintenance of these habitats in Late-Successional Reserves. Furthermore, the goal of the ACS is to maintain and restore physical and biological processes within their natural range of variability and these habitats are natural parts of riparian systems and provide processes that support biological diversity/ecological resilience in the watershed. Therefore, these habitats should be maintained and restored wherever they are found. |
| The reference condition of 50% canopy closure in mature and old growth and recommended thinning or prescribed fire recommendations in Riparian Reserves may be in conflict with maintaining all shade producing trees of perennial streams in 303D listed streams (for water temperature). | Minimize potential for losing shade trees. Develop more large crowned trees more rapidly and use multiple thinning prescriptions, from no treatment to light thinning to wider spacing around certain species (e.g., pines and shade intolerant hardwoods). Mitigation could include some buffering of perennial streams with shade providing trees and/or planting rapid growing hardwoods, like willow, where needed (planted species should be consistent with plant series). |
| Recommendation to avoid burning certain known sensitive plant sites may conflict with recommendations to restore natural fire regime. | Avoid direct ignition of the individual plants, allow fire to creep through buffers. Fire is a natural part of this ecosystem and organisms should be adapted to its affects; however, extra care should be taken to minimize impacts to organisms with low population levels. |

Table T-26: Potential Conflicts Between Recommendations

| Conflicts between Treatment Recommendations | How Conflicts may be Mitigated or Minimized |
|---|---|
| Recommendations to selectively remove "diseased" trees in harvest treatments may conflict with wildlife recommendations to have a significant amount of the large trees with deformities such as cavities, large limbs, and witch's brooms (from mistletoe). Cavities are often promoted by fungi that can impact the value of timber. Cavities in green trees are very valuable to wildlife; e.g., northern spotted owl, because they can last much longer than cavities in a snag that will fall sooner than most green trees. Some fungi promote cavities in green trees (e.g. *Phelinus pini*). | Manage "disease" within natural range of variability. Leave mistletoe infected trees where their impact to smaller trees is reduced; e.g., near the bottom of units. Grow other species of trees in the potential impact area around mistletoe-infected trees. Leave more mistletoe infected trees in units where they are not likely to impact timber; e.g., in stands treated with commercial thinning prescriptions. Leave trees with "pathogens" that have high benefits for wildlife (e.g., *Phelinus pini*) and lower risk to timber value than other diseases (e.g. root diseases that are long lived in soils or stumps). |
| Maintaining an appropriate distribution of age classes or seral stages in Matrix (which includes regeneration harvest) conflicts with the recommendation to maintain and restore old growth and interior mature and old growth forest habitat. | *National Forest Land:* Avoid harvest of old growth habitat and minimize impacts to interior mature and old growth habitat and its connectivity for as long as possible in Matrix while supplying timber to local economies. Schedule harvest to maintain large blocks of mature habitat in Matrix.<br>*BLM land*: Be guided by the 15% late-successional forest retention standard and guide. |
| Recommendations to reduce fuel levels and restore the historic fire regime conflict with S&M management recommendations for certain species. These management recommendations include the protection of certain areas from fire. | Study the affects of fire on these organisms and adjust management recommendations accordingly. Build fire-line and use hand ignition around occupied sites on prescribed fires; these mitigations will appreciably increase costs for prescribed burning. |
| “Sanitization” of Port-Orford cedar helps to maintain mature and old growth forest in Riparian Reserves over the short and long terms. However, not treating this disease could prevent attainment of these maintenance and restoration objectives over the long term. | This is a relatively small impact to Riparian Reserves (only adjacent to roads or only in infected areas) and is considered a long term benefit because treatment reduces the potential for mortality of other Port-Orford cedar in the rest of the drainage below the treatment areas. Leaving dead trees would provide long term down wood. |

# *LITERATURE CITED*

Agee, J.K. 1990. The Historical Role of Fire in Pacific Northwest Forests. In: Walstead, J.D., S.R. Radosevich, and D.V. Sandberg, eds. Natural and Prescribed Fire in the Pacific Northwest. Corvallis OR: Oregon State University Press: 33-34.

Agee, J.K. 1991. Fire History of Douglas-fir Forests in the Pacific Northwest. In: Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285.

Agee, J.K. 1997. Restoration of Blue Mountain Forests with Fire: Is It Possible? Blue Mountains Natural Resource Institute. Vol. 7 No. 3. Agee, J.K., L.Potash, M.Gracz. 1990. Oregon Caves Forest and Fire History. National Park Service Cooperative Park Studies Unit. Report CPSU/UW 90-1.

Atzet, T. And Wheeler, D., 1982. Historical and Ecological Perspectives on Fire Activity in the Klamath Geological Province of the Rogue River and Siskiyou National Forests. USDA - Forest Service, Pacific Northwest Region, Portland, Or. 16 pp.

Atzet, T. and D. Wheeler, 1984. Preliminary Plant Associations of the Siskiyou Mountain Province. USDA Forest Service.

Atzet, T.A. and L.A. McCrimmon, 1990. "Preliminary Plant Associations Of The Southern Oregon Cascade Mountain Province". U.S. Department of Agriculture, Forest Service, Siskiyou National Forest, P.O. Box 440, Grants Pass, OR 97526.

Atzet, T. and R.E. Martin. 1991. Natural Disturbance Regimes in the Klamath Province. In Proceedings of the Symposium on Biodiversity of northwestern California Wildland Resources Center. University of California Berkeley.

Atzet, T., Southwest Ecosystem Assessment Team. 1993. The Range of Natural Conditions. USDA - Forest Service, Siskiyou, Rogue River and Umpqua National Forests. 2 pp.

Atzet, T., D.E. White, L.A. McCrimmon, P.A. Martinez, P.R. Fong, V.D. Randall. 1996. Field Guide to the Forested Plant Associations of Southwestern Oregon. USDA Forest Service. R6-NR-ECOL-TP-17-96

Atzet, T. 1997. Personal communication. Siskiyou National Forest. 200 Greenfield Road (Box 440), Grants Pass, Oregon 97526.

Barbour, R.J., S. Johnston, J.P. Hayes, G.F. Tucker. 1997. Simulated stand characteristics and wood product yields from Douglas-fir plantations managed for ecosystem objectives. Forest Ecology and Management 91 (1997) 205-219.

Barrett, S.J. and J.R. Kohn. 1991. Genetic and Evolutionary Consequences of Small Population Size in Plants: Implications for Conservation. In: Falk, D.A and K.E. Holsinger, Editors. 1991. Genetics and Conservation of Rare Plants. Oxford University Press, New York. 283 pp.

Bingham, B.B. and J.O. Sawyer Jr. 1991. Distinctive Features and Definitions of Young, Mature, and Old-Growth Douglas-fir/hardwood Forests [in Northern California and Southern Oregon]. USDA. PNW-GTR-285.

Borgias, D. 1997. Woodland Succession over 140 years at French Flat: evidence from a time series of Cadastral Surveys. The Nature Conservancy.

Borgias, D. and J. Beigel. 1996. Post Fire Vegetation Recovery in the Serpentine Fens and Savannas of Josephine Creek. Unpublished report on file at the Siskiyou National Forest, Grants Pass, Oregon.

Bork, J. 1985. Fire History in Three Vegetation Types on the East Side of the Oregon Cascades. Ph.D. thesis. Oregon state University, Corvallis, OR. 94p.

Brown, E. Reade (ed). 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington (two volumes). USDA Forest Service, Pacific Northwest Region. Publication No.: R6-F&WL-192-1985. Pacific Northwest Region, 319 SW Pine, PO BOX 3623, Portland, Oregon 97208.

Bulletin 100, 1979. Geology and Mineral Resources of Josephine County, Oregon, State of Oregon, Department of Geology and Mineral Industries.

Bulletin 70, 1971. Geologic Formations of Western Oregon West of Longitude 121'30", State of Oregon, Department of Geology and Mineral Industries.

Coleman, R.G. and A.R. Kruckeberg. 1999. Geology and Plant Life of the Klamath-Siskiyou Mountain Region. Natural Areas Journal, Vol. 19, Number 4, Natural Area Association, Bend, OR.

DellaSala, D.A., S.B. Reid, T.J. Frest, J.R. Strittholt, and D.M. Olsen. 1999. A Global Perspective on the Biodiversity of the Klamath-Siskiyou Ecoregion. Natural Areas Journal, Vol. 19, Number 4. Natural Areas Association, Bend, OR.

Diaz, N.M., and T.K. Mellen. 1996. Riparian Ecological Types. Gifford Pinchot and Mt. Hood National Forests. USDA, Forest Service. R6-NR-TP-10-96.

Drew, T.J., and J.W. Flewelling. 1979. Stand density management: An alternative approach and its application to Douglas-fir plantations. Forest Science 25:518-532.

Fish and Wildlife Service. 1992. Recovery Plan for the Northern Spotted Owl - Draft. 662 pp.

Franklin, J.F. and C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR. General Technical Report PNW-8. 417 pp.

Froelich and McNabb 1986

Geologic Map of California, Weed Sheet, 1964. State of California Division of Mines and Geology.

Geological Survey Quadrangle Map, 1953. Geology of the Galice Quadrangle, USGS.

Geological Survey Bulletin 1247, 1967. Low Temperature Reaction Zones and Alpine Ultramafic Rocks of California, Oregon and Washington, USGS.

Hamrick, J.L., M.J.W. Godt, D.A. Murawski, and M.D. Loveless. 1991. Correlations Between Species Traits and Allozymen Diversity: Implications for Conservation Biology. In: Falk, D.A and K.E. Holsinger, Editors. 1991. Genetics and Conservation of Rare Plants. Oxford University Press, New York. 283 pp.

Henderson, Jan. 1990. Trends in Amount of Old-Growth Forest for the last 100 Years in Western Oregon and Washington. Analysis provided on request to Congressman Bob Smith of Oregon. 283 pp.

Hickman, James C. 1993. The Jepson Manual Higher Plants of California. University of California Press. Berkeley, CA. 1,400 pp.

Hickman. 1998.

Huenneke, L.F. 1991. Ecological Implications of Genetic Variation in Plant Populations. In: Falk, D.A and K.E. Holsinger, Editors. 1991. Genetics and Conservation of Rare Plants. Oxford University Press, New York. 283 pp.

Interagency Scientific Committee. 1990. A Conservation Strategy for the Northern Spotted Owl: Report of the Interagency Scientific Committee to Address the Conservation of the Northern Spotted owl. Thomas, J. W., E. D. Foreman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. USDA Forest Service, USDI Bureau of Land Management, USDI Fish and Wildlife Service, USDI National Park Service. Portland, Oregon. 427 pp.

Jimmerson,T.M. 1992. Uses of Sugar Pine by Cavity-Nesting Birds. In Proceedings of a Symposium Presented by the California Sugar Pine Management Committee. U.C. Davis. Publication 3362.

Jimerson, T.M., L.D. Hoover, E.A. McGee, G..DiNitto, R.M. Creasy, and S.L. Daniel (project coordinator), 1995. <u>A Field To Serpentine Plant Associations And Sensitive Plants In Northwestern California</u>. U.S. Department of Agriculture, Forest Service, Six Rivers National Forest, 500 Fifth Street, Eureka, CA 95001.

Jimerson, T.M., G. DeNitto, K.Hefner-McClelland, E. Hotalen, T. Laurent, D.W. Jones, J. Mattison, E.A. McGee, M.E. Smith, R.J. Svilich, and J.D. Tenpas. 1996. <u>A Field Guide to the Tanoak and Douglas-fir Plant Associations In Northwestern California</u>, U.S. Department of Agriculture, Forest Service, Six Rivers National Forest, 500 Fifth Street, Eureka, CA 95001.

Kagan, J. 1990. Draft Species Management Guide for *Epilobium oreganum, Microseris howellii, Monardella purpurea, Lomatium cookii,* and *Cypripedium fasciculatum* for southwestern Oregon. Oregon Natural Heritage Program, Portland, OR.

Krebs, Charles J. 1985. Ecology, The Experimental Analysis of Distribution and Abundance. Institute of Animal Resource Ecology, The University of British Columbia. Harper Collins Publishers.

Martin, R.E. 1982. Fire history and its role in succession, p. 92-99. *In* Proc., Conference on Research in Natural Parks, Vol.2. Nat. Park Serv., Washington DC.

Martin, Zim, and Nelson. 1951. American Wildlife & Plants A Guide to Wildlife Food Habits. General Publishing Company, Ltd. 30 Lesmill Road, Don Mills, Toronto, Ontario, Canada.

McKinley, G. and Frank, D. 1995. Stores on the Land. An Environmental History of the Applegate and Upper Illinois Valleys. Report prepared for the BLM, Medford District, Medford, Oregon.

Mullens, L. 1995. A Guide to Sensitive Plants of the Siskiyou National Forest. USDA Forest Service, Siskiyou National Forest, Grants Pass, OR. 137 pp.

Oliver, C.D., and Larson, B.C. 1996. Forest Stand Dynamics. Update Edition. John Wiley and Sons, Inc. New York. 520p.

Oregon Natural Heritage Program Data Base. 1997. Portland, Oregon.

Peck, M.E. 1941. A Manual of the Higher Plants of Oregon. Binfords and Mort, Portland, OR. 866 pp.

Personal communication, Joe Cornell, retired Siskiyou National Forest geologist.

Reineke, L.H. 1933. Perfecting a stand-density index for even-aged forests, Journal of Agricultural Research 46:627-638.

Resource Geology Manual, Siskiyou National Forest. 1990. In-house document.

Sensenig, T. 1998. Comparison of Tree Developmental Patterns Among Late-successional and Early-successsional Douglas-fir Forest Stands in the Siskiyou Mountains. USDI, Bureau of Land Management, Medford, Oregon.

Shenon, P.J. 1933. Geology and Ore Deposits of the Takilma-Waldo District, Oregon, including the Blue Creek District. U.S. Geological Survey Bulletin 846-B pp.141-194. Government Printing Office, Washington D.C.

Skinner, Mark S. and Pavlik, Bruce M. 1994. California Native Plant Society's Rare and Endangered Vascular Plants of California, Fifth Edition.

Smith, Jane Kapler, ed. 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42-vol. 1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83 p.

Soil Resource Inventory, Siskiyou National Forest, 1979.

Soil Survey of Josephine County Oregon, 1983. USDA Soil Conservation Service.

Stein, W.I., 1990. Quercus garryana Dougl. ex Hook,: Oregon white oak. In: Burns, Russell M.; Honkala, Barbara H., tech. coords. Silvics Of North America: Volume 2, hardwoods. Agric. Handb. 654. Washington DC: Forest service, U.S. Department of Agriculture: 650-660.

Street, W. and E. Street. 1973. *Sailors' Diggings.* Josephine County Historical Society Reprints, Grants Pass, Oregon 44p.

Swanson, F.J. 1981. Fire and Geomorphic Processes. In Mooney, H., et al. (eds.), Fire regimes and ecosystem properties: Proceedings of the conference: pp. 410-20. USDA Forest Service General Technical Report WO-26.

Tappeiner, J.C., D. Huffman, D. Marshall, T.A. Spies, and J.D.Bailey. 1997. Density, ages, and growth rates in old-growth and young-growth forests in coastal Oregon. Can.J.For.Res. 27:638-648 (1997).

Taylor, A.H. and C.N.Skinner. 1998. Fire History and Landscape Dynamics in a Late-successional Reserve, Klamath Mountains, California, USA. Forest Ecology and Management 111 (1998) 285-301.

USDA Forest Service. 1989. Snag Densities on the Gasquet Ranger District, Six Rivers National Forest, California. Jimerson

USDA Forest Service. 1989. Final Environmental Impact Statement, Land and Resource Management Plan, Siskiyou National Forest. 200 Greenfield Road (Box 440), Grants Pass, Oregon 97526.

USDA Forest Service. 1991. Forest Service Manual (FSM 2620.3). Washington D.C.

USDA Forest Service. 1991. Forest Service Manual: wildlife, fish, and sensitive plant management (Section 2670), WO Amendment 2600-91-3, effective 5/31/91.

USDA Forest Service. 1993. Region 6 Interim Old Growth Definition for Port-Orford-cedar and Tanoak Series. In: Region 6 Interim Old Growth Definition.

USDA Forest Service. 1995. Forest Service Manual: Series 2000 - National Forest Resource Management, WO Amendment 2000-95-5, effective 11/29/95 - Noxious Weed Management.

USDA Forest Service. 1996. Siskiyou Supplement Guidelines for Harvest Prescriptions - Large Woody Material, Green Tree Retention, and Wildlife Reserve (Snag) Tree Retention, Siskiyou National Forest. 200 Greenfield Road (Box 440), Grants Pass, Oregon 97526.

USDA Forest Service. 1996. A Field Guide to the Tanoak and the Douglas-fir Plant Associations In Northwestern California. USDA Forest Service, Pacific Southwest Region. R5-ECOL-TP-009.

USDA Forest Service. 1997. List of Proposed, Endangered, Threatened, and Sensitive species (plants and animals). Pacific Northwest Region, 319 SW Pine, PO Box 3623, Portland, Oregon 97208

USDA Forest Service. 1998. WILDOBS, Wildlife Observation Database. Siskiyou National Forest. 200 Greenfield Road (Box 440), Grants Pass, Oregon 97526.

USDA Forest Service. 1998. Geographical Information System Data Dictionary. Siskiyou National Forest 200 Greenfield Road (Box 440), Grants Pass, Oregon 97526.

USDA Forest Service. 1998. Wildfire Prevention Analysis and Plan. Siskiyou National Forest. Grants Pass, Oregon 97526.

USDA Forest Service. 1978-1999. Sensitive and endemic plant records and plant survey records on file at Siskiyou National Forest Supervisor's Office, Grants Pass, Oregon.

USDA Forest Service. 1994-1998. Sucker, Althouse, and Indigo Creeks; and West Fork and East Fork Illinois River Ecosystem Analyses. Illinois Valley Ranger District, 26568 Redwood Hwy. Cave Junction, Oregon 97523 and Galice Ranger District, 200 Greenfield Road (Box 440), Grants Pass, Oregon 97526.

USDA Forest Service; USDI BLM, Fish and Wildlife Service, and National Park Service; USDC National Oceanic and Atmospheric Administration National Marine Fisheries Service; EPA Environmental Protection Agency. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment - Report of the Forest Ecosystem Management Assessment Team (FEMAT). *Old-Growth conifer stand defenitions*, p. IX-24.

USDA Forest Service / USDI BLM. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late- Successional and Old- Growth Forest Related Species Within the Range of the Northern Spotted Owl. Contact: USDA Forest Service, P.O. Box 3623, Portland, OR 97208.USDI

USDA Forest Service / USDI BLM. 1995. Southwest Oregon Late-Successional Reserve Assessment; Medford District, Bureau of Land Management, Department of Interior; and Siskiyou National Forest, U.S. Forest Service, Department of Agriculture; Medford and Grants Pass, Oregon.

USDA Forest Service / USDI BLM. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. Forest Service/Bureau of Land Management. Portland, Oregon.

USDI BLM. 1994 Medford District of the Bureau of Land Management Resource Management Plan. Medford, Oregon.

USFS/BLM. 1996. Rogue River/South Coast Biological Assessment FY97/98 Timber Sale Projects FY97/05 For All Other Projects. Medford District Bureau of Land Management Rogue River and Siskiyou National Forests.

Van Wagner, C.E., 1978. Age-Class Distribution and the Forest Fire Cycle. Canadian Journal of Forest Resources, Vol 8. 7pp.

White, D.E., Atzet, T., Martinez, P.A., McCrimmon, L.A. 1997. Fire Regime Variability by Plant Association in Southwestern Oregon. Presented at the Symposium on Fire in California Ecosystems. San Diego, CA.

Williams, Jerry T. 1994. The Biswell Symposium; Fire=s role in Support of Ecosystem Management

Zika, P. 1994. Purple Toothwort Cardamine nuttallii var. gemmata in the Siskiyou National Forest. Oregon Natural Heritage Program, Portland, OR. 53 pp.

Zobel et al. 1985

# APPENDIX A: Wildlife

## I. National Forest Lands - Species of Concern

**Table T-A-1a: National Forest Lands: Species of Concern Distribution and Abundance (current)**

| COMMON NAME | SPECIES OF CONCERN Reason | PRESENT: yes, no, or unknown | DISTRIBUTION: % of suitable habitat surveyed in watershed, FS | ABUNDANCE: % of watershed population surveyed, FS |
|---|---|---|---|---|
| Peregrine falcon | ESA-delisted | yes | < 1% | <1% |
| Bald eagle | ESA-delisted | no | <1% | 0 |
| Marbled murrelet | ESA-threatened | no | <5% | 0 |
| Northern spotted owl | ESA-threatened | yes | <25% | <25% |
| Olympic salamander | NFP-J2; additional analysis needed | unknown | < 1% | < 1% |
| Clouded salamander | NFP-J2; additional analysis needed | unknown | < 1% | < 1% |
| Tailed frog | NFP-J2; additional analysis needed | unknown | < 1% | < 1% |
| Common merganser | NFP-J2; additional analysis needed | unknown | < 1% | < 1% |
| Wolverine | R5&6-sensitive | unknown | < 1% | < 1% |
| Osprey | R6-mgmt. Indicator | potential | <1% | < 1% |
| Lewis' woodpecker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Acorn woodpecker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Red-breasted sapsucker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Williamson's sapsucker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Downy woodpecker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Hairy woodpecker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| White-headed woodpecker | R6-mgmt. Indicator | yes | < 1% | < 1% |
| Northern flicker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Pileated woodpecker | R6-mgmt. Indicator | likely | < 1% | < 1% |
| Roosevelt elk | R6-mgmt. Indicator | yes | <70% | < 1% |
| Columbian black-tailed deer | R6-mgmt. Indicator | yes | <70% | < 1% |
| Black- backed 3-toed woodpecker | R6-mgmt. Indicator; NFP-J2; additional analysis | unknown | <1 % | < 1 % |
| Marten | R6-mgmt. Indicator; R5- sensitive | unknown | <1 % | < 1 % |
| Red-legged frog | R6-sensitive | unknown | <1 % | < 1 % |
| Western pond turtle | R6-sensitive | unknown | <1 % | < 1 % |
| Common kingsnake | R6-sensitive | likely | <1 % | < 1 % |
| California mountain kingsnake | R6-sensitive | likely | <1 % | < 1 % |
| Townsend's big-eared bat | R6-sensitive | unknown | <1 % | < 1 % |
| White-footed vole | R6-sensitive | unknown | <1 % | < 1 % |
| Certain mollusks | NFP-ROD; Survey & mg. | yes | <5% | < 1 % |
| Red tree vole | NFP-ROD-survey&mg. | likely | <1 % | < 1 % |
| Pallid bat | NFP-ROD-survey&mg. | unknown | <1 % | < 1 % |
| Silver-haired bat | NFP-ROD-survey&mg. | unknown | <1 % | < 1 % |
| Long-eared myotis | NFP-ROD-survey&mg. | unknown | <1 % | < 1 % |
| Fringed myotis | NFP-ROD-survey&mg. | unknown | <1 % | < 1 % |
| Long-legged myotis | NFP-ROD-survey&mg. | unknown | <1 % | < 1 % |
| Goshawk | R5-sensitive | Yes | <10% | < 1 % |
| Great Grey owl | NFP-ROD-survey&mg. R5-sensitive | unknown | <2 % | < 1 % |

| **Table T-A-1a: National Forest Lands: Species of Concern Distribution and Abundance (current)** | | | | |
|---|---|---|---|---|
| COMMON NAME | SPECIES OF CONCERN Reason | PRESENT: yes, no, or unknown | DISTRIBUTION: % of suitable habitat surveyed in watershed, FS | ABUNDANCE: % of watershed population surveyed, FS |
| Del Norte salamander | NFP-ROD-survey&mg. R6-sensitive | yes | <5 % | < 1 % |
| Siskiyou Mountains salamander | NFP-ROD-survey&mg. R6-sensitive | unknown | <5 % | < 1 % |

ESA = Endangered Species Act; NFP J2 = Northwest Forest Plan Appendix J2 / S&M species; ROD = Record of Decision for NFP;
R6 = Region 6 Forest Service; R5 = Region 5 Forest Service; mgmt. Indicator = species used as indicators of effects from management practices.

# II. BLM SPECIES OF CONCERN

| **Table T-A-1b: BLM Lands: Species of Concern Distribution and Abundance (current)** | | | | |
|---|---|---|---|---|
| COMMON NAME | SPECIES OF CONCERN Reason | PRESENT: yes, no, or unknown | DISTRIBUTION: % of suitable habitat surveyed in watershed, BLM | ABUNDANCE: % of watershed population surveyed, BLM |
| Peregrine falcon | SS (SE) | | < 1% | ? |
| Bald eagle | SS (FT,ST) | | <1% | 0 |
| Marbled murrelet | | No | <4% | 0 |
| Northern spotted owl | SS (FT,ST) | ?? | <??% | <??% |
| Black salamander | SS (AS, SP) | | | |
| Clouded salamander | SS (AS, SC) | | < 1% | < 1% |
| Tailed frog | SS (AS, SV) | | < 1% | < 1% |
| Lewis' woodpecker | SS (AS, SC) | | <1 % | < 1% |
| White-headed woodpecker | SS (AS, SC), BF | | <1 % | < 1% |
| Pileated woodpecker | SS (AS,SC) | | <1 % | < 1% |
| Great Grey owl | SS (AS, SC), BF | Yes | <14 % | < 1 % |
| Pygmy owl | | Yes | <5 % | < 1 % |
| Flammulated owl | SS (AS, SC), BF | | | |
| Northern saw-whet owl | SS (AS) | | | |
| Northern goshawk | SS (SC) | No | <9 % | < 1 % |
| Loggerhead shrike | SS | | | |
| Mountain quail | SS | | | |
| Western bluebird | SS (AS, SC) | | | |
| Purple martin | SS (AS, SC) | | | |
| Western meadowlark | SS (AS) | | | |
| Pygmy nuthatch | BF | | | |
| Fisher | SS (AS, SC) | | <1 % | < 1 % |
| Marten | SS (AS, SC) | | <1 % | < 1 % |
| Red-legged frog | SS | | <1 % | < 1 % |
| Western pond turtle | SS (SC) | | <1 % | < 1 % |
| Common kingsnake | SS (AS, SP) | | <1 % | < 1 % |
| California mountain kingsnake | SS (AS, SP) | | <1 % | < 1 % |
| Sharptail snake | SS (AS, SC) | | | |
| Townsend's big-eared bat | SS (SC) | | <1 % | < 1 % |
| Certain mollusks (S&M) | SM | Yes | <30 % | < 1 % |
| Red tree vole | SM | Yes | <7 % | < 1 % |
| Pallid bat | SM | | <1 % | < 1 % |

| **Table T-A-1b: BLM Lands: Species of Concern Distribution and Abundance (current)** | | | | |
|---|---|---|---|---|
| COMMON NAME | SPECIES OF CONCERN Reason | PRESENT: yes, no, or unknown | DISTRIBUTION: % of suitable habitat surveyed in watershed, BLM | ABUNDANCE: % of watershed population surveyed, BLM |
| Silver-haired bat | SM | | <1 % | < 1 % |
| Long-eared myotis | SM | | <1 % | < 1 % |
| Fringed myotis | SS (BS, SV), SM | | <1 % | < 1 % |
| Long-legged myotis | SM | | <1 % | < 1 % |
| Del Norte salamander | SS (SV), SM, BF | | <25 % | < 1 % |
| Siskiyou Mountain salamander | | | <25 % | < 1 % |
| SS = Special Status (FE-federal endangered, FT-federal threatened, SE-state endangered, ST-state threatened, SC-state candidate, SV-state vulnerable, SP-state peripheral, and AS-assessment species); SM = Survey and Manage; BF = Buffer Species | | | | |

## III. Habitats for Wildlife Species of Concern

Tables T-A-2 and T-A-3 identify major known habitat components that the species of concern require. Information summarized in these tables is from "Management of Fish and Wildlife Habitats of Western Oregon and Washington" (Brown et. al., 1985) and the Siskiyou Forest Plan. These tables depict species habitat associations for wildlife species of concern in the East Fork of the Illinois River ecosystem.

Table T-A-2: Wildlife Species of Concern, Habitat Associations

**Wildlife Species of Concern (FS & BLM) Habitat Associations**

| COMMON NAME | GF | SD | PS | YF | MF | OG | CB | CR | DM | SN | TA | RI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Peregrine falcon | 2 | 2 | | | 2 | 2 | | 1 | | 2 | 2 | 1 |
| Bald eagle | 1 | | | | 2 | 2 | | | | 1 | | 1 |
| Marbled murrelet | | | | | 2 | 1 | | | | | | 2 |
| Northern spotted owl | | | | | 2 | 1 | | | | 2 | | |
| Olympic salamander | | | 2 | 1 | 1 | 1 | | | | | 1 | 1 |
| Clouded salamander | 1 | 1 | 1 | 1 | 2 | 2 | | | 1 | 2 | 2 | |
| Tailed frog | 2 | 2 | 1 | 1 | 1 | 1 | | | 1 | | 2 | 1 |
| Common merganser | | | | | 1 | 1 | | | 2 | 1 | | 1 |
| Wolverine | | | | | | | 1 | | 1 | | 1 | 1 |
| Osprey | | | | | 2 | 2 | | | | 1 | | 1 |
| Lewis' woodpecker | 2 | 1 | 1 | | 2 | 2 | | | 1 | 1 | | |
| Acorn woodpecker | | | 2 | | 2 | 2 | | | 2 | 1 | | |
| Red-breasted sapsucker | | | 2 | 2 | 2 | 2 | | | | 1 | | 1 |
| Williamson's sapsucker | | | 2 | 2 | 2 | 2 | | | | 1 | | |
| Downy woodpecker | | | 2 | 2 | 2 | 2 | | | | 1 | | 1 |
| Hairy woodpecker | | | 2 | 2 | 2 | 1 | | | 1 | 1 | | 2 |
| White-headed woodpecker | | | | 2 | 2 | 1 | | | 2 | 1 | | |
| Northern flicker | 1 | 2 | 2 | | 1 | 1 | | | 1 | 1 | | 2 |
| Pileated woodpecker | | | | 2 | 2 | 1 | | | 1 | 1 | | 2 |
| Roosevelt elk | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | 1 |
| Columbian black-tailed deer | 1 | 1 | 1 | 2 | 2 | 2 | | | 2 | | | 2 |
| Black- backed 3-toed woodpecker | | | 2 | 2 | 2 | 2 | | | | 2 | 1 | 2 |
| Marten | | | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 |
| Red-legged frog | 2 | | | 2 | 2 | 2 | | | | | | 1 |
| Western pond turtle | 1 | 1 | | | | | | | 1 | | | 1 |

Table T-A-2: Wildlife Species of Concern, Habitat Associations

**Wildlife Species of Concern (FS & BLM) Habitat Associations**

| COMMON NAME | GF | SD | PS | YF | MF | OG | CB | CR | DM | SN | TA | RI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Peregrine falcon | 2 | 2 | | | 2 | 2 | | 1 | | 2 | 2 | 1 |
| Common kingsnake | 1 | 1 | 2 | 2 | | | | | 2 | | 2 | |
| California mountain kingsnake | | 1 | 1 | 1 | 2 | 2 | | | 2 | | | 1 |
| Townsend's big-eared bat | | 2 | 1 | 2 | | | 1 | | | | | 2 |
| White-footed vole | | 2 | 2 | 2 | 1 | 1 | | | 1 | | | 1 |
| Red tree vole | | | | 2 | 2 | 2 | | | | | | 2 |
| Pallid bat | 1 | | 1 | 2 | 2 | 2 | 1 | 1 | | 2 | | 1 |
| Silver-haired bat | 2 | | 1 | 2 | 2 | 1 | 2 | 2 | | 1 | | 2 |
| Long-eared myotis | | | 2 | 2 | 1 | 1 | 2 | | 1 | | | 1 |
| Fringed myotis | 1 | 1 | | | 2 | 2 | 1 | 1 | | 2 | | 1 |
| Long-legged myotis | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | | 1 | | 1 |
| Great Grey owl | | | | | | | | | | | | |
| Del Norte salamander | | | | 1 | 1 | 1 | | | 2 | | 1 | |
| Siskiyou Mountains salamander | | | 2 | 1 | 1 | 1 | | | 2 | | 1 | 2 |
| Northern goshawk | | | | 2 | 2 | 2 | | | 2 | 2 | | 2 |
| Loggerhead shrike | | | | | | | 2 | | | | | 1 |
| Mountain quail | 2 | 1 | 2 | | | | | | | | | 2 |
| Black salamander | | | | | | | | | | | | |
| Fisher | | | | 2 | 1 | 1 | | 2 | 1 | 1 | 1 | 2 |
| Western bluebird | 1 | 1 | 2 | 2 | 2 | 2 | | | | 1 | | |
| Flammulated owl | | | 1 | 1 | | | | | | 2 | | |
| Northern saw-whet owl | 1 | 2 | 2 | 2 | 2 | 1 | | | | 1 | | 2 |
| Sharptail snake | 1 | 1 | 1 | 1 | 2 | 2 | | | 1 | | 1 | |
| Purple martin | 2 | 2 | 2 | | 2 | 2 | | | | 1 | | 2 |
| Western meadowlark | 2 | | | | | | | | | | | 2 |
| Pygmy nuthatch | | | | 2 | 1 | 1 | | | 2 | 1 | | |
| TOTAL NUMBER OF PRIMARY USERS | 12 | 12 | 12 | 9 | 13 | 17 | 5 | 4 | 13 | 20 | 7 | 19 |
| TOTAL NUMBER OF SECONDARY USERS | 9 | 7 | 13 | 23 | 27 | 20 | 4 | 3 | 10 | 8 | 5 | 15 |
| | **GF** | **SD** | **PS** | **YF** | **MF** | **OG** | **CB** | **CR** | **DM** | **SN** | **TA** | **RI** |

GF=grass/forb, SD=shrub dominated, PS=pole sapling, YF=young forest, MF=mature forest, OG=old growth forest, CB=caves and burrows, CR=cliffs and rims, DM=down woody material, SN=snags, TA=talus, RI=riparian (includes all water habitats) 1= Primary Habitat 2= Secondary Habitat

There are 38 vertebrate wildlife species of concern identified in Table T-A-2 with their preferred habitats: grass/forb, shrub, seedling/sapling/pole, young forest, mature forest, old growth forest, caves & burrows, cliffs & rims, large down wood, snags, talus, and riparian/aquatic. Habitats with the most vertebrate species of concern using them as primary habitat are: old growth forest (20 species), snags (20), riparian/aquatic (19), large down wood (13), and mature forest (13).

**Table T-A-3: Habitat Components for Species Associated with Late-Successional and Old-Growth Forest (from the NW Forest Plan).**

Wildlife Habitat Associations with Late-Successional and Old Growth Habitats

| Species/ Guilds | LS/OG (large saw/ old growth) | Riparian | Snags | Down Woody Material | Large Green Trees | Canopy Closure | Unique Habitats |
|---|---|---|---|---|---|---|---|
| Northern spotted owl (FSEIS 3&4, pg. 234+) | large patches | yes | yes | yes | yes | yes | |
| Marbled Murrelet (FSEIS 3&4, pg. 246+) | trees>32'd.b.h. w/nesting platforms | | | | trees>32'd.b.h. w/nesting platforms | | |
| Bald Eagle (FSEIS pg. 206+) | nest | | | | nest trees | | large water, i.e., rivers and lakes |
| Peregrine Falcon (FSEIS, pg. 254+) | | | | | | | cliffs; often forages in forest |
| Invertebrates: Arthropods (FSEIS, pg. 2-75) | extensive and inter-connected | yes | yes | yes | yes; diversity of old growth | yes; canopy structure | |
| Invertebrates: Mollusks (FSEIS, pg. 2-76) | LS/OG influences quality of moist habitats | moist forest, i.e.; springs, bogs, marshes | | | | | talus: basalt and limestone |
| Amphibians (FSEIS, pg. 2-76) | extensive and inter-connected. LS/OG influences quality of cool moist habitats | low sediment, cool water, and head-water streams | | yes | | | |
| Birds (FSEIS, pg. 2-76&77) | large reserves | yes | yes | yes | green trees, large and small | | |
| Bats (FSEIS, pg. 2-77) | yes | yes | yes | yes | | | |
| Mammals -other than bats- (FSEIS, pg. 2-77) | yes: some spp. Like fisher may need large unfragmented expanses of LS/OG | yes | yes | yes | yes | some, e.g.; fisher, marten, and tree voles | |

## Table T-A-4: Modeling Assumptions

| Habitat Components | Current Condition; East Fork of the Illinois River | Historic/Reference Condition: East Fork of the Illinois River |
|---|---|---|
| | PMR pixel data:<br>Size Structure Codes | Modeled PMR pixel data to pre-harvest condition :<br>Size/Structure Codes |
| Non-Forest | | |
| Grass/Forb | | |
| Shrub Dominated | | |
| Seed/sap/pole<br>(< 9"dbh) | 10, 11, 20, 23, 27, 30, 33, 35, 36, 37, 38 | 10, 11, 12, 20, 23, 24, 27, 30, 33, 35, 36, 37, 38 |
| Young Forest<br>(9-21" dbh) | 12, 13, 24 | 13, 14, 15, 21, 22, 28, 39 |
| Mature Forest<br>(21-32" dbh) | 14, 15, 16, 21, 22, 25, 28, 39 | 16, 25 |
| Old Growth<br>(> 32" dbh) | 17, 18, 19, 26, 29, 31, 32, 34 | 17, 18, 19, 26,29, 31, 32, 34 |
| Interior Older Forest (Mature and Old Growth patches larger than 20 ac.) | Combined Mature and Old Growth and subtracted 400 ft . from the outside edge of stands for ``edge effect.' The remaining area is ``interior habitat.' | Combined Mature and Old Growth and subtracted 400 ft. from the outside edge of stands for ``edge effect.' The remaining area is ``interior habitat.' |

General modeling assumptions using PMR pixel data to develop ``pre-harvest condition' data -

Before timber harvest:

all current regeneration harvest areas were old-growth,
unmanaged forests of old-growth were old-growth,
unmanaged mature forests were young forests,
unmanaged young forests were pole forests, and
unmanaged seed/sap/pole forests remained the same.
Other unmanaged habitats, (i.e., water, rock, grass, shrub) remained the same.

It is difficult to model pre-harvest conditions for young and seed/sap/pole stands; therefore, PMR historic/reference information for these size classes has limited value.

For more precise information about these assumptions, see the data dictionary for this data.

# APPENDIX B: Wildland Fire Management

## I. Fire Management Hazard, Risk, and Value At Risk Rating Classification Method and Assumptions and Planning

The Forest Service and Bureau of Land Management use slightly different criteria to evaluate Hazard, Risk and Values at Risk. While compatible, the relative ratings are not directly comparable between agencies. For example, a "high" hazard rating using one set of criteria may be a "medium" hazard using the other. The classification methods and assumptions for both agencies are described below. (See Maps 19 through 22)

### A. BLM Administered and Non-Federal Lands

#### 1. Hazard

Hazard rating is based on the summation of the points assigned based on six elements as follows:

1) Slope:

| Percent | Points |
|---|---|
| 0-19 | 5 |
| 20-44 | 10 |
| 45+ | 25 |

2) Aspect:

| Degree | Points |
|---|---|
| 316-360, 0-67 | 5 |
| 68-134, 294-315 | 10 |
| 135-293 | 15 |

3) Position On Slope

| | Points |
|---|---|
| Upper 1/3 | 5 |
| Mid-Slope | 10 |
| Lower 1/3 | 25 |

4) Fuel Model:

| Model | Points |
|---|---|
| Grass 1, 2, 3 | 5 |
| Timber 8 | 5 |
| Shrub 5 | 10 |
| Timber 9 | 15 |
| Shrub 6 | 20 |
| Timber 10 | 20 |
| Slash 11 | 25 |
| Shrub 4 | 30 |
| Slash 12, 13 | 30 |

5) Ladder Fuel Presence:
(Use when forest vegetation has DBH of 5" or greater (vegetation condition class 6). Exceptions are possible based on stand conditions.)

| | Points |
|---|---|
| Ladder fuel absent. | 0 |
| Present on less than one-third of area; vertical continuity > or < 50%. | 5 |
| Present on one-third to two-thirds percent of area; vertical continuity is <50%. | 15 |
| Present on one-third to two-thirds percent of area; vertical continuity is > 50%. | 25 |
| Present on greater than two-thirds percent of area; vertical continuity is <50%. | 30 |
| Present on greater than two-thirds percent of area; vertical continuity is > 50%. | 40 |

6) Summary Rating:

| POINTS | HAZARD RATING |
|---|---|
| 0-45 | LOW |
| 50-70 | MODERATE |
| 75-135 | HIGH |

**2. Risk**

Assigned based on human presence and use, and on lightning occurrence.

**High rating** when human population areas are present on or adjacent within 1/4 mile of the area; area has good access with many roads; relatively higher incidence of lightning occurrence; area has high level of human use.

**Moderate rating** when area has human access and experiences informal use; area is used during summer and fall seasons as main travel route or for infrequent recreational activities. Lightning occurrence is typical for the area and not notably higher.

**Low rating** when area has limited human access and infrequent use. Baseline as standard risk, mainly from lightning occurrence with only rare risk of human fire cause.

**3. Value at Risk**

Best assigned through interdisciplinary process. Based on human and resource values within planning areas. Can be based on land allocations, special use areas, human improvements/monetary investment, residential areas, agricultural use, structures present, soils, vegetation conditions, and habitat.

Examples:

**High rating** - ACEC, RNA, LSR, Special Status species present, critical habitats, recreation area, residential areas, farming, vegetation condition and McKelvey Ratings of 81, 82, 71, 72; vegetation condition of 4 and 5. Caves, cultural, or monetary investment present. Riparian areas.

**Moderate rating** - Granitic soils, informal recreation areas and trails. Vegetation and McKelvey Rating of 85, 75, 65.

**Low rating** - Vegetation condition class 1, 2, 3; and vegetation 5, 6, 7 with McKelvey Rating 4.

## B. National Forest Lands

The Siskiyou National Forest Wildfire Prevention Analysis and Plan (1998) analyzed fire risk, hazard, and values at risk for lands within the National Forest boundary. It did not consider private lands or other federal ownership outside of the forest boundary. The plan identified five fire prevention compartments within the East Fork Illinois watershed. Fire Risk, Hazard and Value were assigned for each of these compartments. Ratings were somewhat subjective with an objective of making comparisons between compartments on the forest. Map 20A (Wildfire Risk Analysis) and Table T-B-1 display the composite rankings for the National Forest portion of the watershed (Risk / Hazard / Value). NOTE: The Hazard rating for compartment IV07 was changed from "Low" to "Moderate" to reflect the predominate Tanoak and Douglas-fir Series in the area. This change corrects an error in the original plan.

Table T-B-1: Wildfire Risk Analysis Summary Ratings (Risk/Hazard/Value)

| Rating | Acres | Percent |
|---|---|---|
| HMH | 1,164 | 3 |
| MMH | 29,995 | 82 |
| LLL | 5,387 | 3 |

The Wildfire Prevention Plan identified compartments with rankings of HHH, HMH, MHH and MMH as high priorities for hazardous fuels treatment on National Forest lands.

### 1. Hazard, Risk and Values at Risk for the East Fork Watershed

Fire risk and Values at Risk were taken directly from the Wildfire Prevention Plan for compartments within the East Fork Illinois watershed. Fire hazard was further refined to prioritize hazardous fuels treatments within the watershed.

#### a. Fire Hazard

From a fire suppression perspective, the wild land fuels management objective is to "identify, develop and maintain fuel profiles that contribute to the most cost-efficient fire protection and use program in support of forest plan land and resource management direction" (FSM 5150.2).

A standard analysis process (the NFMAS process) identifies the "most efficient level" of initial attack forces for a forest, based on the ability to suppress a wildfire on an average worst day (90th percentile weather conditions), given prevailing slope and the fuel profile. The initial attack organization for the Two Rivers Fire Zone is comprised of fire engines staffed by personnel using fire line hand-tools and the limited water the engines carry. Personnel using hand tools can safely, directly attack a fire with flame lengths less than 4 feet at the head or flanks. Higher intensity fires require bulldozers, aircraft or indirect attack to safely suppress. When flame lengths are greater than 4 feet, initial attack forces will have difficulty containing a wildfire.

Fire Hazard is measured by the ability of the Zone's initial attack organization to control a wildfire on an average worst fire weather day. See Fire Hazard Categories Table T-B-2.

**Table T-B-2: Forest Service Fire Hazard Categories**

| Category | Parameters |
|---|---|
| High Hazard | Initial attack forces are unable to contain a fire start. Average flame lengths are over 8 feet. |
| Moderate Hazard | Initial attack forces are able to contain a fire but heavy equipment or air resources are the primary tools. Flame lengths are from 4 to 8 feet. |
| Low Hazard | Initial attack forces are able to control the fire with direct methods e.g. engines and hand tools Average flame lengths are less than 4 feet. |

Fire Hazard was determined for lands within the forest boundary of the watershed by using a computer model called the BEHAVE Fire Behavior Prediction System. Topography was integrated by generating both slope steepness and aspect maps from topographic files in GIS. 90th percentile fire weather conditions were taken from the Onion Mountain weather station for the years 1977 to 1996. The combination of fuel models, 3 slope classes, and 90th percentile fire weather (adjusted for aspect and fuel model) predicted the fire behavior (flame lengths) and subsequent Fire Hazard (see Map 21).

b. Risk

Assessing the risk consists of evaluating the potential for wildfire ignition. Concentrations of lightning and human activities that could start fires were identified. A risk overlay was completed for the forest, identifying areas as low, medium or high risk of ignition. This rating was relative in nature and considered only the risk of one compartment as compared to another.

c. Values at Risk

Assessing values is a subjective process and is interdisciplinary in nature. Areas of obvious value, where wildfire could have an undesirable resource effect, are labeled as high. Areas with some value, but considered less in comparison, are labeled as medium. Everything else is considered low. The Siskiyou National Forest Land and Resource Management Plan was used to help assign values. Value ratings were based on management area allocations as shown below:

| Table T-B-3: Forest Service Value Criteria | | | |
|---|---|---|---|
| **VALUE CRITERIA** | | | |
| | **Low** | **Medium** | **High** |
| Wilderness (MA1) | X | | |
| Back Country Recreation (MA6) | | X | |
| Late-Successional Reserve (MA8) | | | X |
| Special Wildlife Site (MA9) | | X | |
| Riparian Reserves (MA11) | | X | |
| Retention Visual (MA12) | | X | |
| Partial Retention Visual (MA13) | | | X |
| Matrix (MA14) | | | X |

## II. Fuel Models

Fire behavior is determined largely by weather, topography, and the fuel profile. Thirteen fire behavior fuel models (Anderson 1982) were developed to aid in the prediction of fire behavior (fire spread and intensity) for various fuel conditions. The criteria for choosing a fuel model to predict fire behavior primarily considers the fact that fire will burn in the fuel stratum that is most conducive to support the fire. Fuels can be classified into four groups (grasses, brush, timber, and slash) depending on what carries the fire. The difference in fire behavior among these groups is related to the amount of fuel, its distribution among the fuel size classes, and the depth of the fuel bed. Grasses and brush are vertically oriented fuel groups, and timber litter and slash are horizontally oriented.

Eight fuel models were identified in the watershed (see Table T-B-4, Fire Behavior Fuel Models, and Map 19 Fuel Model). For National Forest lands, vegetation conditions derived from satellite imagery data (interpreted by Pacific Meridian Resources), and the age and type of harvest for managed stands were used to determine fuel models. The fuel model descriptions are listed below:

Fuel Model 1 (Grass Group): Fire spread is governed by the fine, continuous, herbaceous fuels which are cured (or nearly cured). Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area. Annual and perennial grasses are included in this fuel model.

Fuel Model 2 (Grass Group): Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stem-wood from the open shrub or timber over-story, contribute to the fire intensity. Open shrub lands and pine stands or scrub oak stands that cover one-third to two-thirds of the area may generally fit this model; such stands may include clumps of fuels that generate higher intensities and that may produce firebrands.

Fuel Model 5 (Shrub Group): The fire is generally carried by the surface fuels made up of litter cast by the shrubs and the grasses or forbs in the under-story. The fire is not generally very intense because surface fuels loads are light, the shrubs are young with little dead material and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood would qualify: sprouting hardwoods, ceanothus species, young plantations or manzanita. Stands maybe up to 6 feet high, but have poor burning properties because of live vegetation.

Fuel Model 6 (Shrub Group): Fire will carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 miles per hour at mid flame height. Fire will drop to the ground at low wind speeds or at openings in the stand. This model covers a broad range of shrub conditions. The shrubs are older than fuel model 5, but do not contain as much fuel as model 4. Fuel situations include intermediate stands of ceanothus, huckleberry oak and dense plantations.

Fuel Model 8 (Timber Group): Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather, conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand.

Fuel Model 9 (Timber Group): Fires run through the surface litter faster than a Model 8 and have longer flame lengths. Closed stands of pines or other conifers or hardwoods may fall into this model. Concentrations of dead or down woody material will contribute to possible torching out of trees.

Fuel Model 10 (Timber Group): The fire burns in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger limb-wood resulting from over-maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. A forest type may be considered if heavy down material is present: examples are insect and disease-ridden stands, wind-thrown stands, over-mature situations with dead fall, and aged light thinning or partial-cut slash.

Fuel Model 11 (Logging Slash Group): Fire is fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from over-story, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands or hardwood stands are considered. Clear-cut operations generally produce more slash than represented here.

| Table T-B-4: Fire Behavior Fuel Models, Current Conditions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fuel Model** | **National Forest** | | **BLM** | | **Non-Federal** | | **All Ownerships** | |
| | **Acres** | **Percent** | **Acres** | **Percent** | **Acres** | **Percent** | **Acres** | **Percent** |
| 1 | 49 | <1 | 988 | 20 | 4,806 | 30 | 5,843 | 10 |
| 2 | 423 | 1 | - | - | - | - | 423 | <1 |
| 5 | 14,615 | 40 | 828 | 16 | 5,351 | 34 | 20,794 | 36 |
| 6 | 4,164 | 11 | 133 | 3 | 434 | 3 | 4,731 | 8 |
| 8 | 6,183 | 17 | 2,018 | 40 | 2,630 | 16 | 10,831 | 19 |
| 9 | - | - | 894 | 18 | 1,277 | 8 | 2,171 | 4 |
| 10 | 10,884 | 30 | 88 | 2 | 827 | 5 | 11,799 | 20 |
| 11 | 284 | <1 | - | - | - | - | 284 | <1 |
| N/A | - | - | 94 | 2 | 628 | 4 | 722 | 1 |
| **Total** | 36,602 | - | 5,043 | - | 15,953 | - | 57,598 | - |

# APPENDIX C: Plant Series

## A. Plant Series Extent

Vegetation series are used to display and describe the abundance, distribution, and diversity of plant communities in the watershed. Series are named after the species of trees that would dominate a site if there were no disturbances. Few sites in Southwest Oregon are dominated by such "climax" species due to frequent and pervasive past disturbance. Series is useful in characterizing the vegetation and estimating biological productivity (Atzet and Wheeler 1984).

Maps 9A and 9B, 10, 11 and 12 display the vegetation information by ownership within the East Fork Illinois Watershed. This is a broad scale estimate for most of the watershed. Accurate mapping of series and plant association groups is a *data gap* for National Forest lands. The most common plant series is the Tanoak Series, followed by the White fir, Douglas-fir, and Jeffrey Pine Series (see Table T-C-1) The mapping on National Forest lands includes a tanoak/Douglas-fir type where the two series were lumped when they could not be readily distinguished by aerial photo interpretation. Minor amounts of Mountain Hemlock, Red Fir and Oregon White Oak Series are also found within the watershed, but were not mapped on Forest Service administered lands. Douglas-fir is the dominant over-story tree in both the Tanoak and White Fir Series due to its fire resistant characteristics and repeated fires in the watershed.

Table T-C-1: Plant Series in the East Fork Illinois Watershed

| Plant Series | Acres | % of Ownership | % of Watershed |
|---|---|---|---|
| **WITHIN NATIONAL FOREST BOUNDARY** | | | |
| Tanoak or Douglas-fir [1] | 15,558 | 42 | 27 |
| White Fir | 14,539 | 40 | 25 |
| Douglas-fir | 3,487 | 10 | 6 |
| Tanoak | 1,784 | 5 | 3 |
| Port-Orford-cedar | 911 | 2 | <2 |
| Jeffrey pine | 405 | 1 | <1 |
| **BLM LANDS** | | | |
| Douglas-fir | 3,049 | 63 | 6 |
| Jeffrey pine | 1,336 | 24 | 2 |
| Ponderosa pine | 95 | 2 | <1 |
| Tanoak | 442 | 9 | <1 |
| White oak | 5 | <1 | <1 |
| Riparian hardwood | 19 | <1 | <1 |
| Non-vegetated | 97 | 2 | <1 |
| **NON-FEDERAL OWNERSHIP** | | | |
| Douglas-fir | 3,607 | 23 | 6 |
| Jeffrey pine | 1,375 | 9 | 2 |
| Tanoak | 1,700 | 11 | 3 |
| White oak | 87 | <1 | <1 |
| Non-vegetated | 628 | 4 | 1 |
| Non-forest<br>Includes rural development and Cave Junction | 8,431 | 53 | 15 |

[1] Could not be differentiated

## B. Plant Series Descriptions

### 1. Douglas-fir Series

The Douglas-fir Series occurs on warmer, drier sites with moderately shallow soils. The series is replaced by the White Fir Series on cooler higher elevation sites and by Tanoak on moist lower elevation sites. Douglas-fir dominates the over-story with both sugar and ponderosa pine usually present. Productivity is somewhat lower than for tanoak, but often high. Fire exclusion has allowed an increase in tree density with a corresponding loss of pine species from insect attack. In the Elder Creek drainage, many stands on ultrabasic parent materials exhibit an under-story of incense cedar and Douglas-fir. Estimated mean fire return interval was 15 years.

### 2. Jeffrey Pine Series

This Series can be identified by the presence of Jeffrey pine. It only occurs on soils derived from ultrabasic parent materials. The Series is characterized by low site productivity. Douglas-fir and incense cedar are common under-story and over-story tree associates. A characteristic feature of the Series is an open over-story canopy of trees, with a shrub and grass under-story. Fire exclusion has probably had little effect on over-story trees, but under-story brush and trees have increased in density. Many of these under-story trees are depauperate.

### 3. Ponderosa Pine Series

Forests in the Ponderosa Pine Series generally average approximately 170 $ft^2$ per acre of basal area. This Series is relatively rare, as ponderosa pine does not often play the role of a climax dominant species (Atzet and Wheeler 1984). This Series tends to occupy hot and dry sites that burned frequently. Ponderosa pine regeneration is generally reduced with fire exclusion. Because of fire exclusion over the past 70 years, overall distribution of ponderosa pine has declined.

### 4. Port-Orford Cedar Series

This series occurs at mid to low elevations and tends to follow stream drainages. It is mostly riparian associated in the watershed and is usually discontinuous. POC root disease is the most significant disturbance to the series. Estimated fire return interval was 50 years. This is longer than adjacent upland series due to the moist environment.

### 5. Tanoak Series

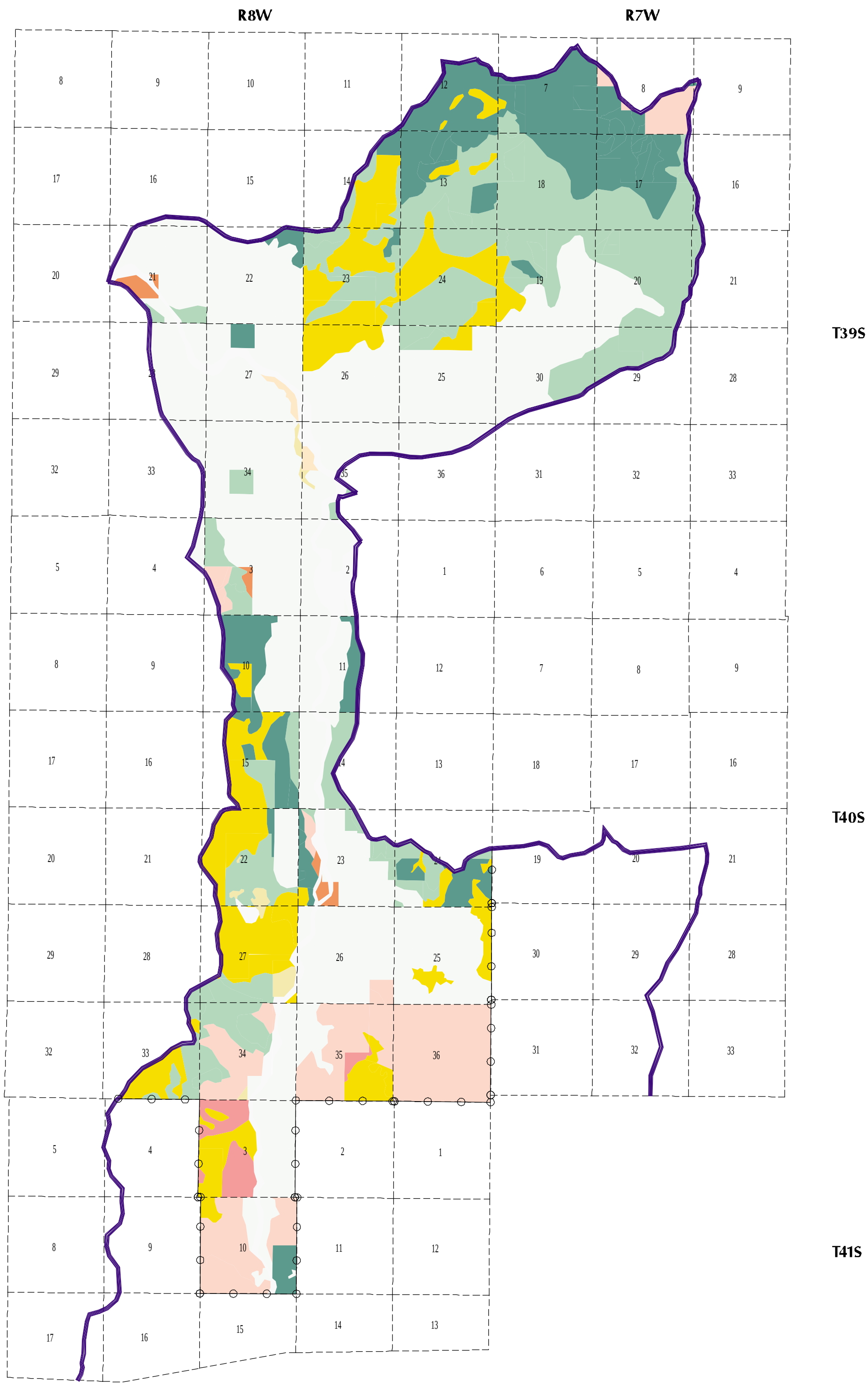
Tanoak areas tend to be those of deep productive soils below about 3,000 feet in elevation. The presence of tanoak often indicates higher site productivity. The distribution of tanoak is limited by the availability of summer moisture and cold winter temperatures. Tanoak sites are usually dominated by Douglas-fir and sugar pine. Fire exclusion has allowed tanoak to increase in density, diameter and height in most stands. Estimated mean fire return interval was 12 years (White et al. 1997).

### 6. White Fir Series

This series is located on cooler, higher elevation sites above about 3,000 feet in the watershed. It is rare on ultrabasic parent material. These sites are usually dominated by mixed conifer over-stories with a major component of Douglas-fir. Productivity is usually high. Fire exclusion has allowed white fir to increase both in the under-story and as a component of the over story. Estimated mean fire return interval was 25 years.

### 7. White Oak Series

This Series generally occurs at lower elevations and is characterized by shallow soils. Although Oregon white oak is usually considered a xeric species, it also commonly occurs in very moist locations such as flood plains, heavy clay soils and river terraces. On better sites, white oak is out-competed by species that grow faster and taller (Stein 1990). Average basal area is 46 $ft^2$ per acre. Water deficits significantly limit survival and growth (Atzet and McCrimmon 1990). White oak has the ability to be a climax species in that it can survive in environments with low annual or seasonal precipitation, droughty soils, and where fire is a repeated natural occurrence (Stein 1990). Fire events in this series are high in frequency but low in intensity (Atzet and McCrimmon 1990). Because of fire exclusion over the past 70 years, the overall distribution of white oak has declined.




SCALE 1:110000

# PLANT SERIES ON LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

John McGlothlin

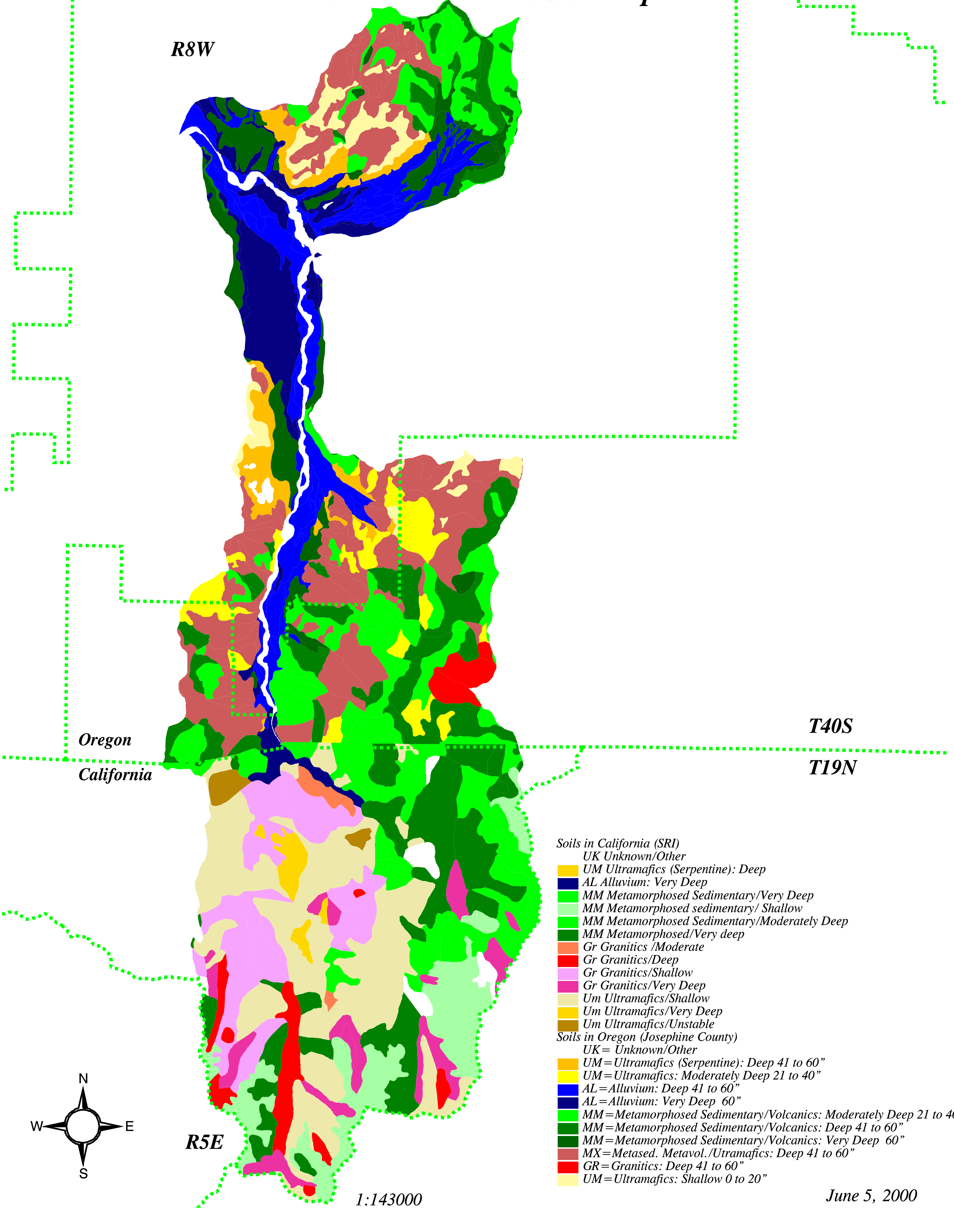
**LEGEND**

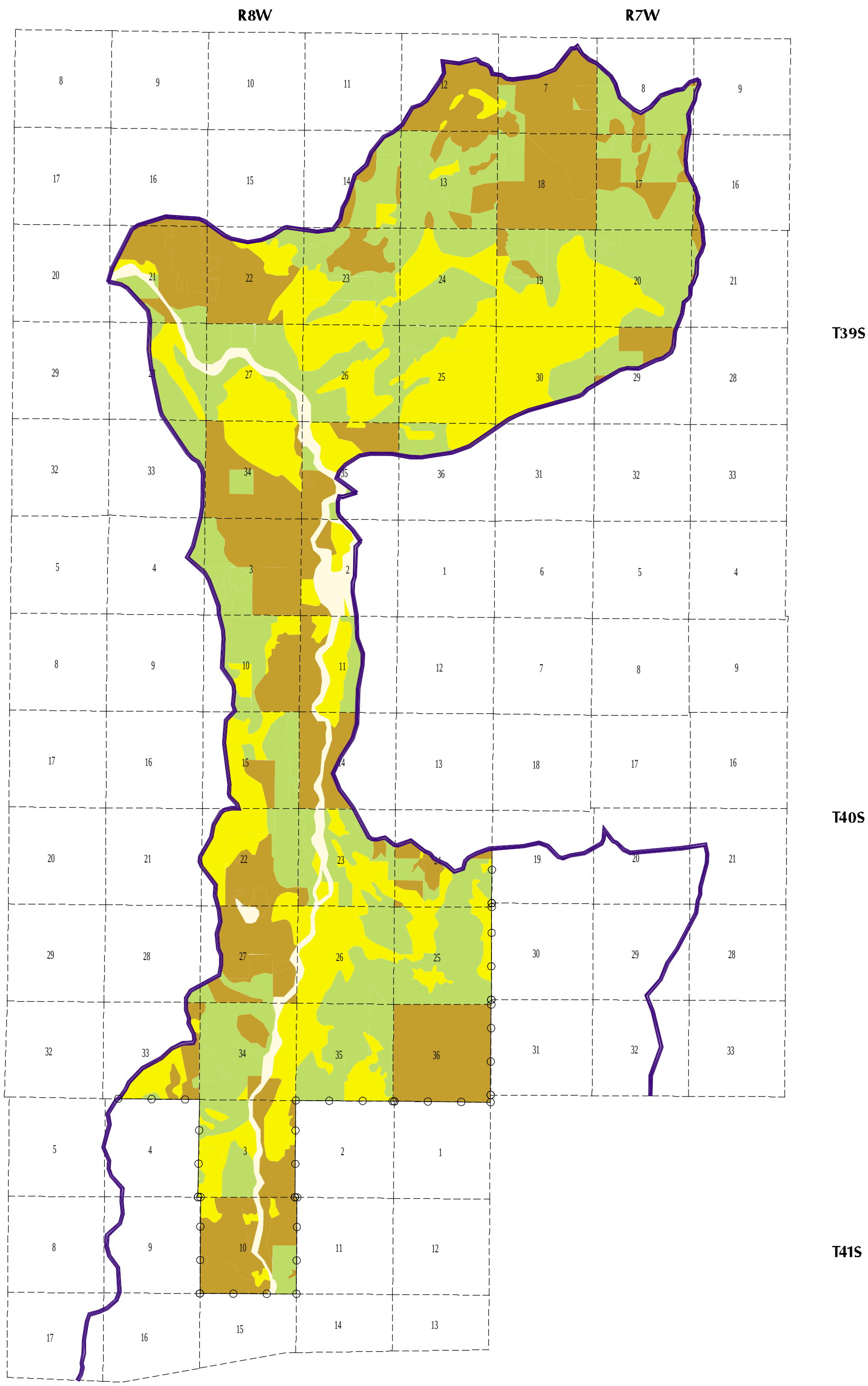
- NON-VEG.
- NON-FOREST
- RIPARIAN HARDWOOD
- TANOAK
- TANOAK/ D.FIR
- W.OAK
- J.PINE
- P.PINE
- D.FIR/ PINE
- D.FIR
- WATERSHED BOUNDARY
- USFS BOUNDARY

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.

# East Fork Illinois Watershed
# Parent Material and Soil Depth






SCALE 1:110000

# FUEL MODELS FOR LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

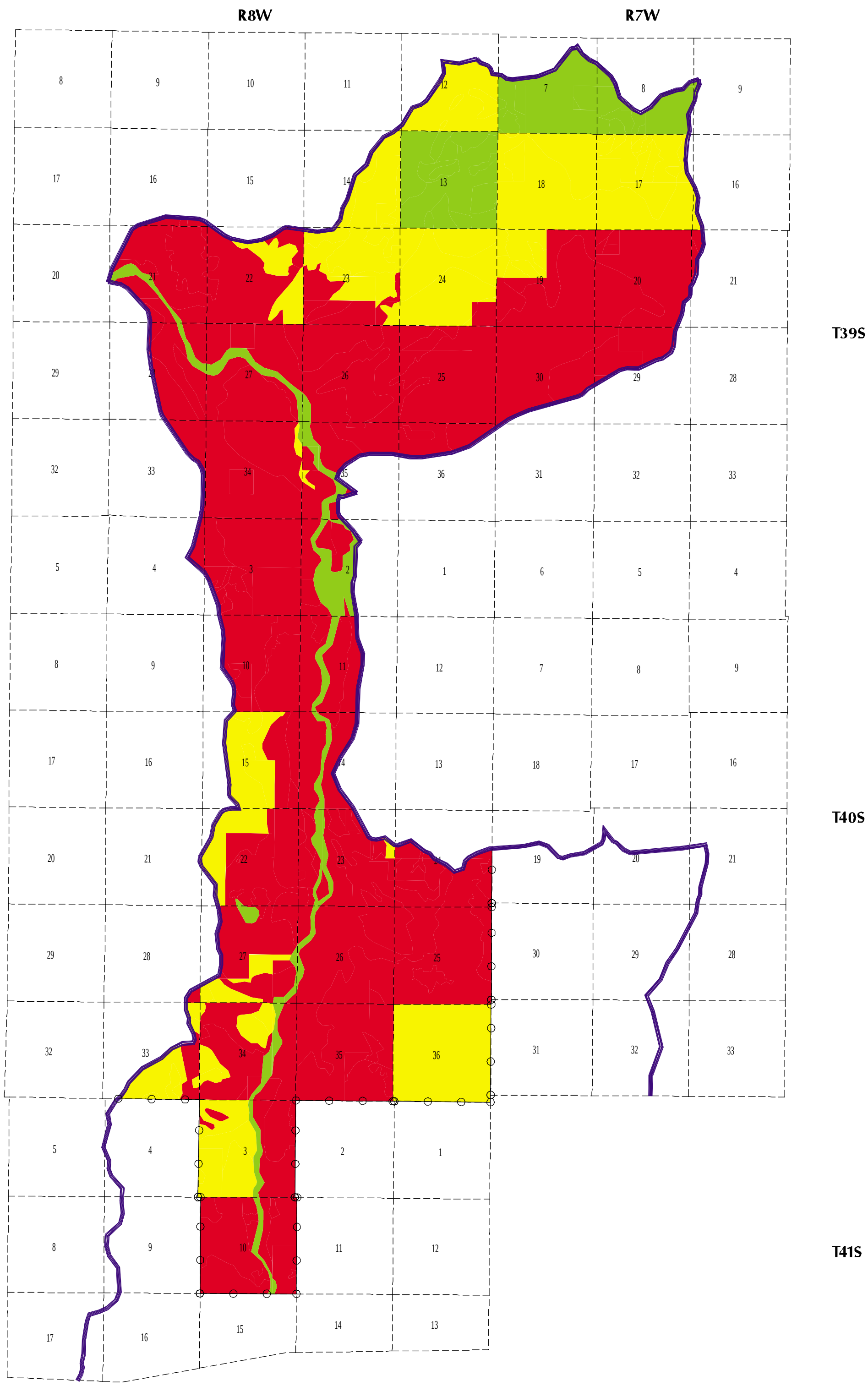
John McGlothlin

**LEGEND**

- GRASS AND GRASS DOMINATED
- CHAPARRAL AND SHRUB FIELDS
- TIMBER LITTER
- SLASH
- FUEL MODELING NOT APPLICABLE
- WATERSHED BOUNDARY
- USFS BOUNDARY

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.




SCALE 1:110000

# FIRE RISK RATING FOR LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

**LEGEND**

- HIGH
- MEDIUM
- LOW
- WATERSHED BOUNDARY
- USFS BOUNDARY

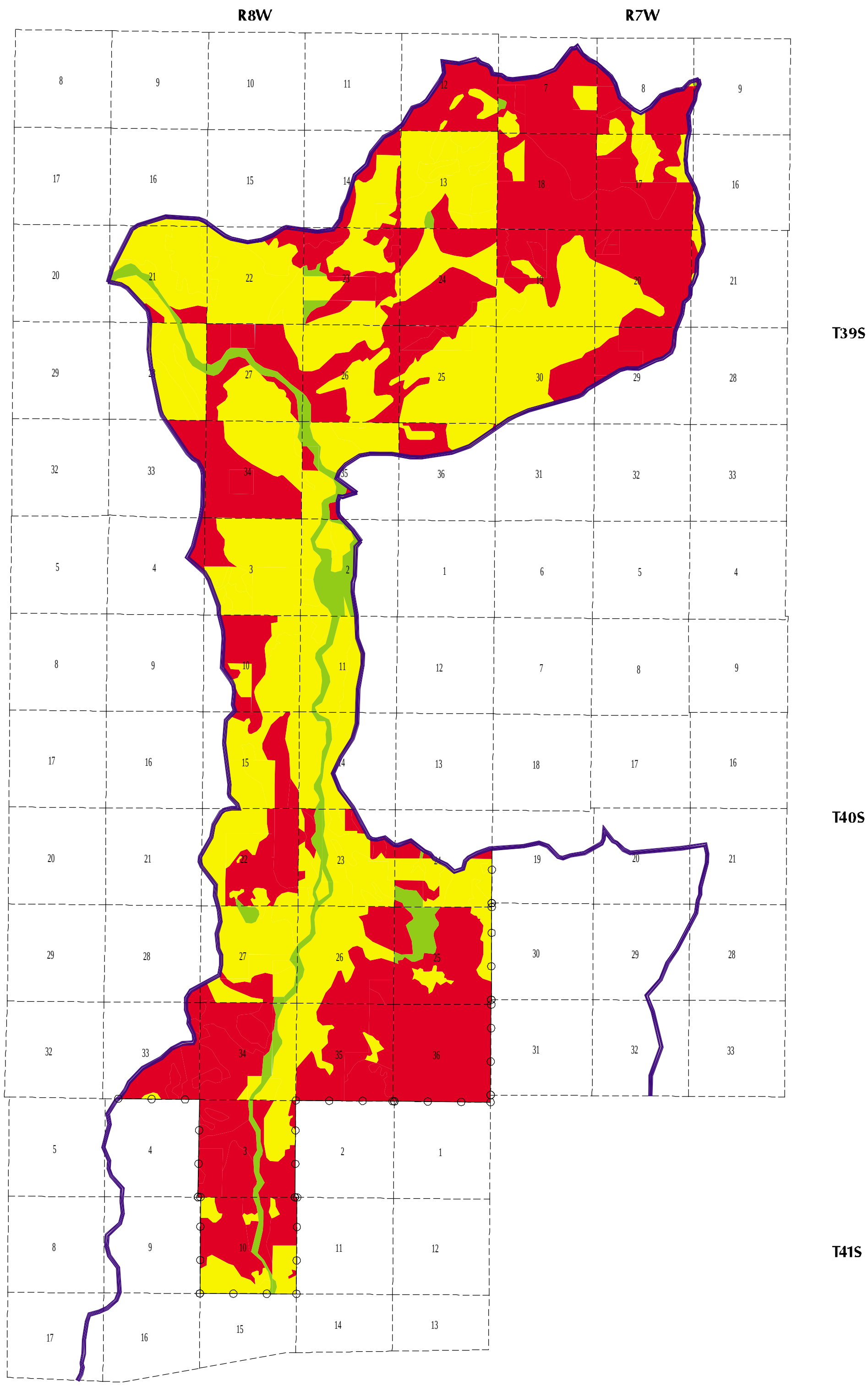
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

John McGlothlin

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.




SCALE 1:110000

# FIRE HAZARD RATING FOR LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

LEGEND

- HIGH
- MEDIUM
- LOW
- WATERSHED BOUNDARY
- USFS BOUNDARY

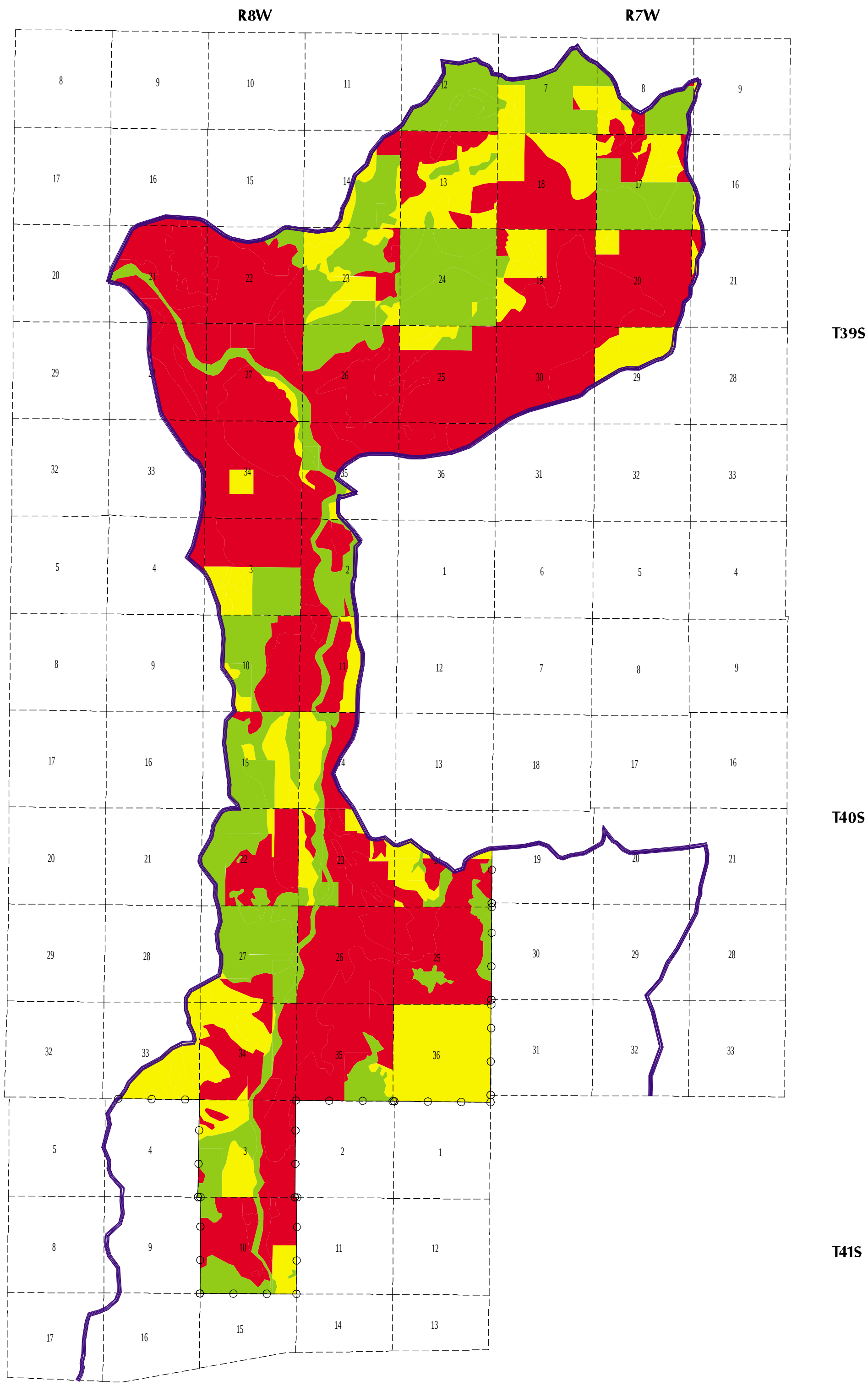
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

John McGlothlin

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.




SCALE 1:110000

# FIRE VALUE RATING FOR LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

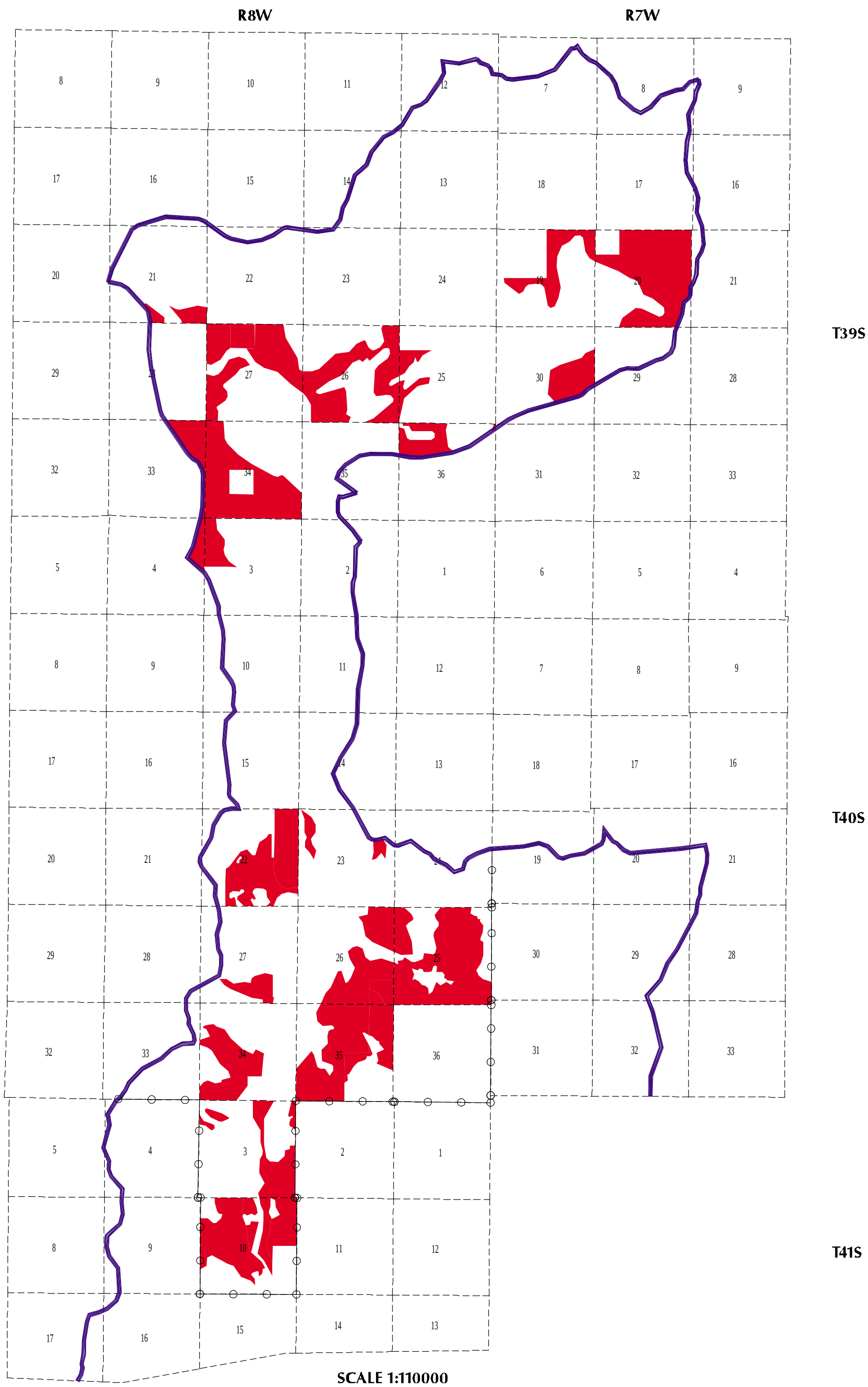
John McGlothlin

LEGEND

- HIGH
- MEDIUM
- LOW
- WATERSHED BOUNDARY
- USFS BOUNDARY

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.




SCALE 1:110000

# POTENTIAL HIGH PRIORITY
# HAZARD REDUCTION TREATMENT AREAS
# OUTSIDE THE USFS BOUNDARY
# IN THE EAST ILLINOIS WATERSHED

LEGEND

Areas With High Ratings

WATERSHED BOUNDARY

USFS BOUNDARY

N

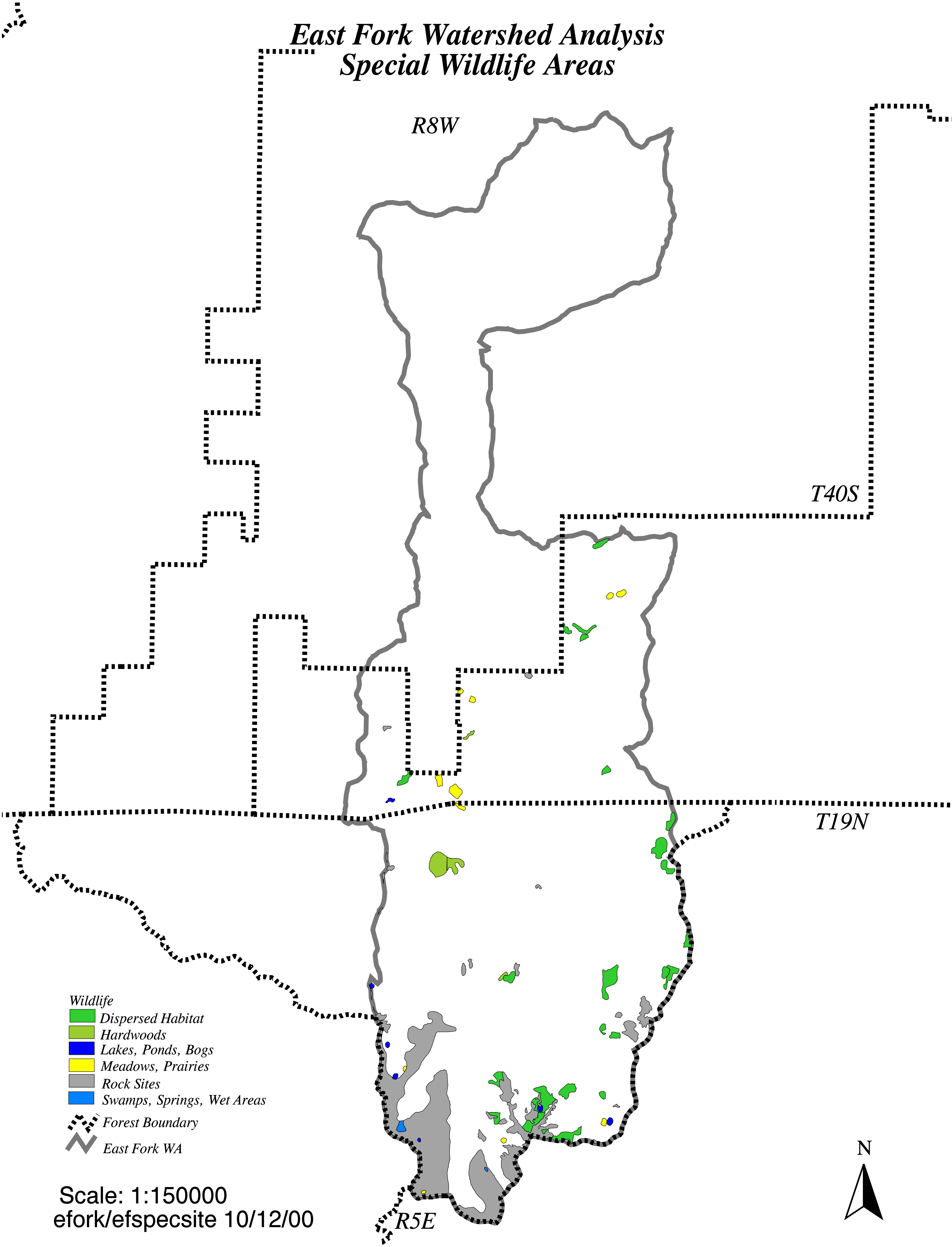
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

John McGlothlin

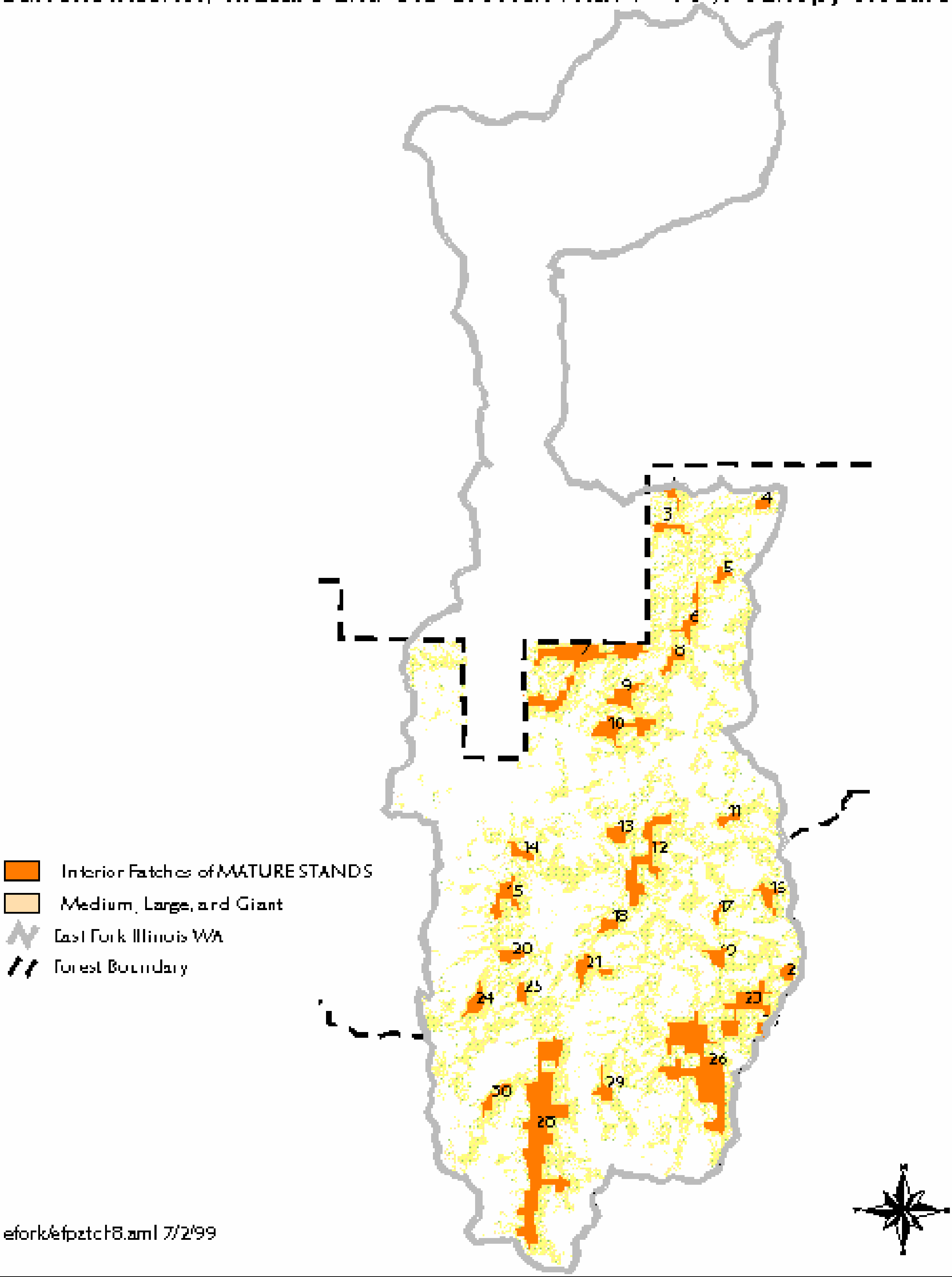
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.

# East Fork Watershed Analysis
# Special Wildlife Areas

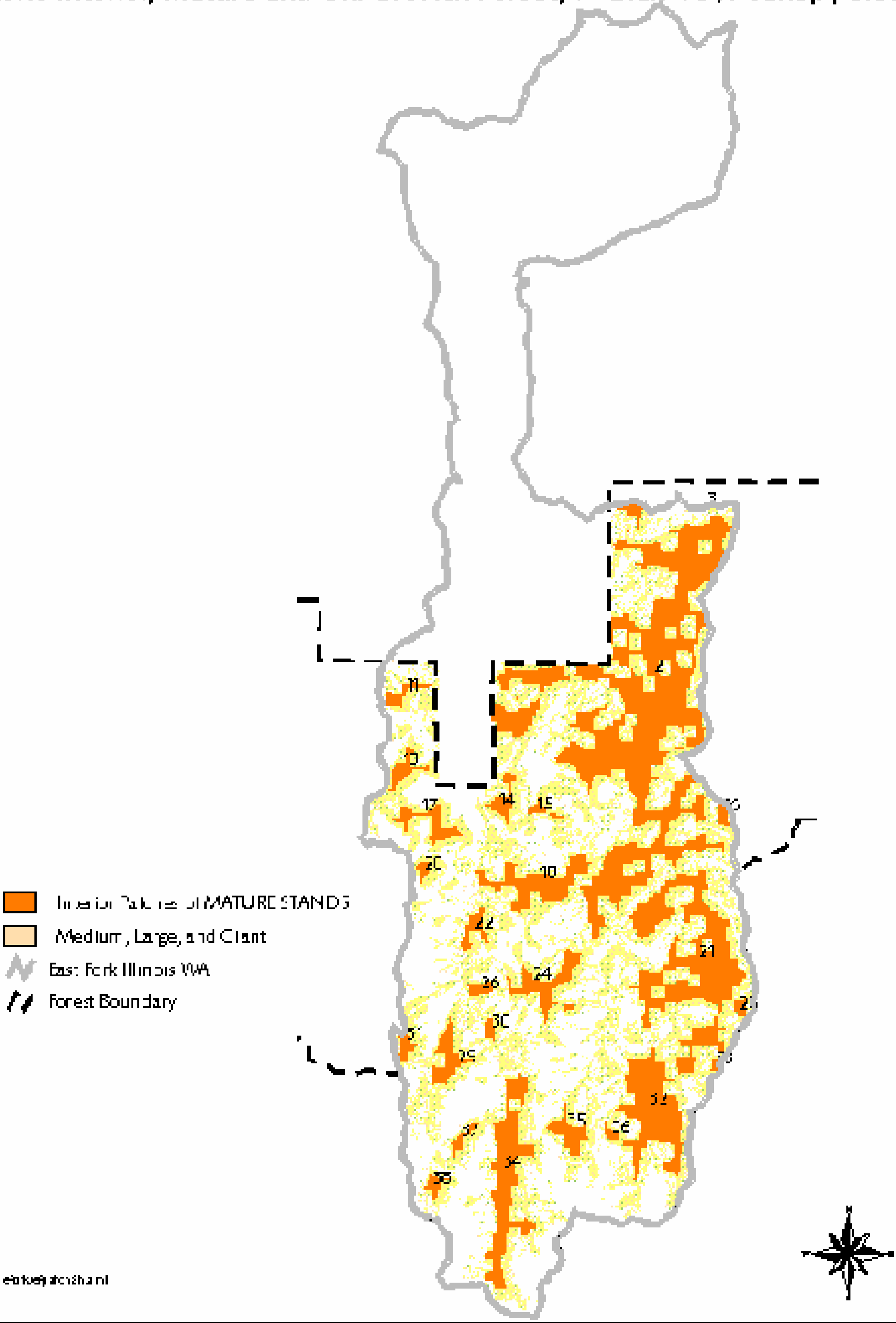


# East Fork Watershed Analysis

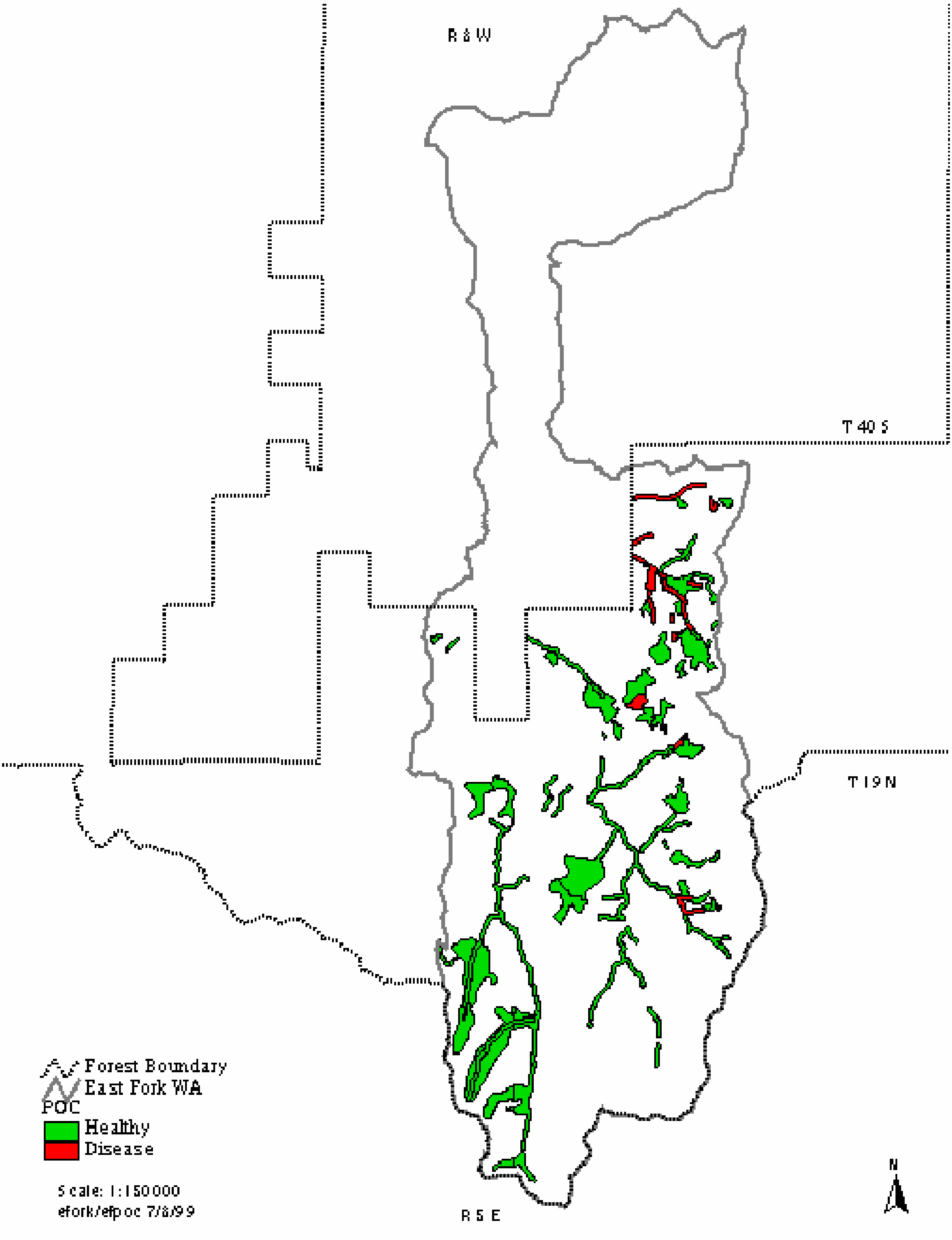
## Current Interior/ Mature and Old Growth with > 40% canopy closure



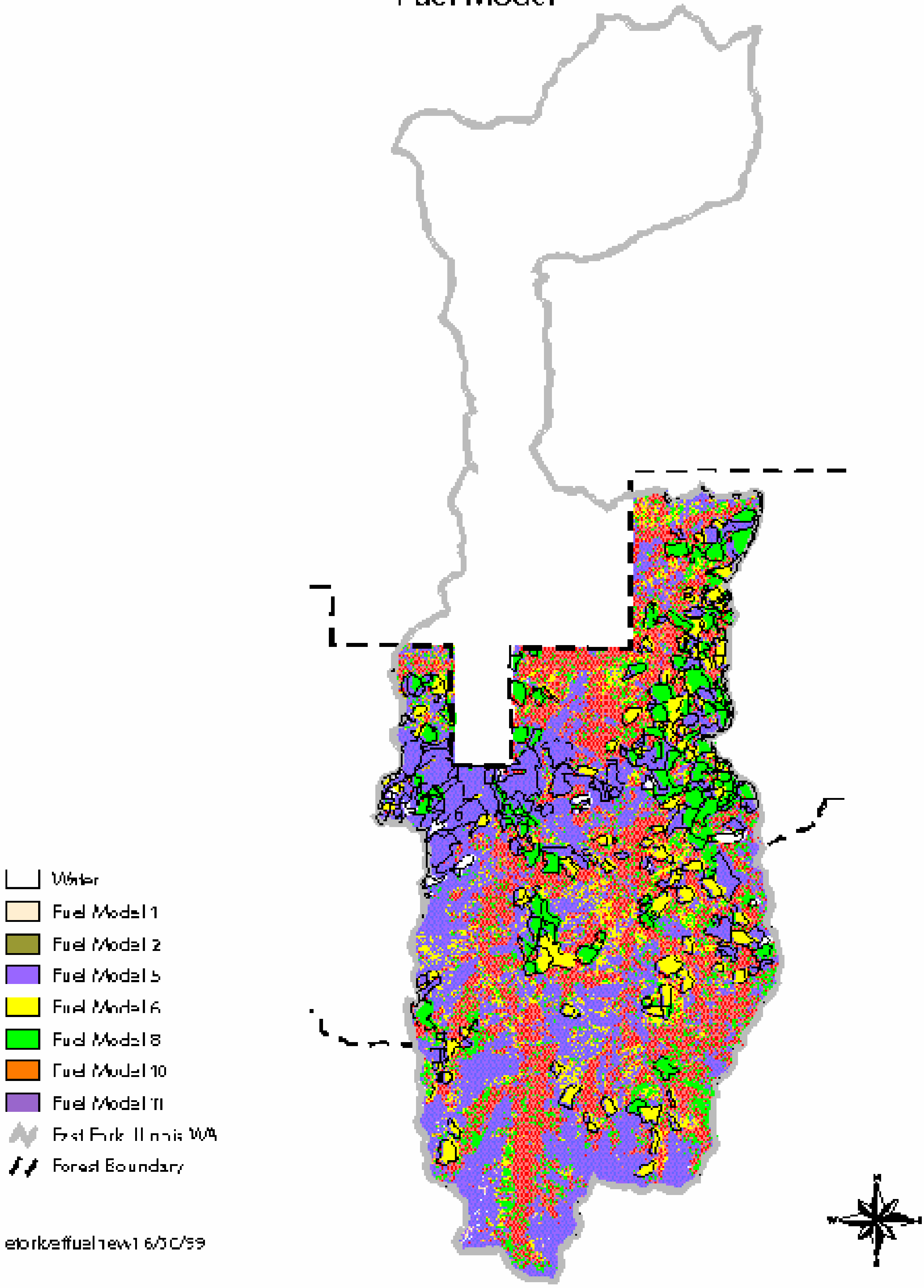
# East Fork Watershed Analysis
## Historic Interior, Mature and Old Growth Forest, > than 40% canopy closure



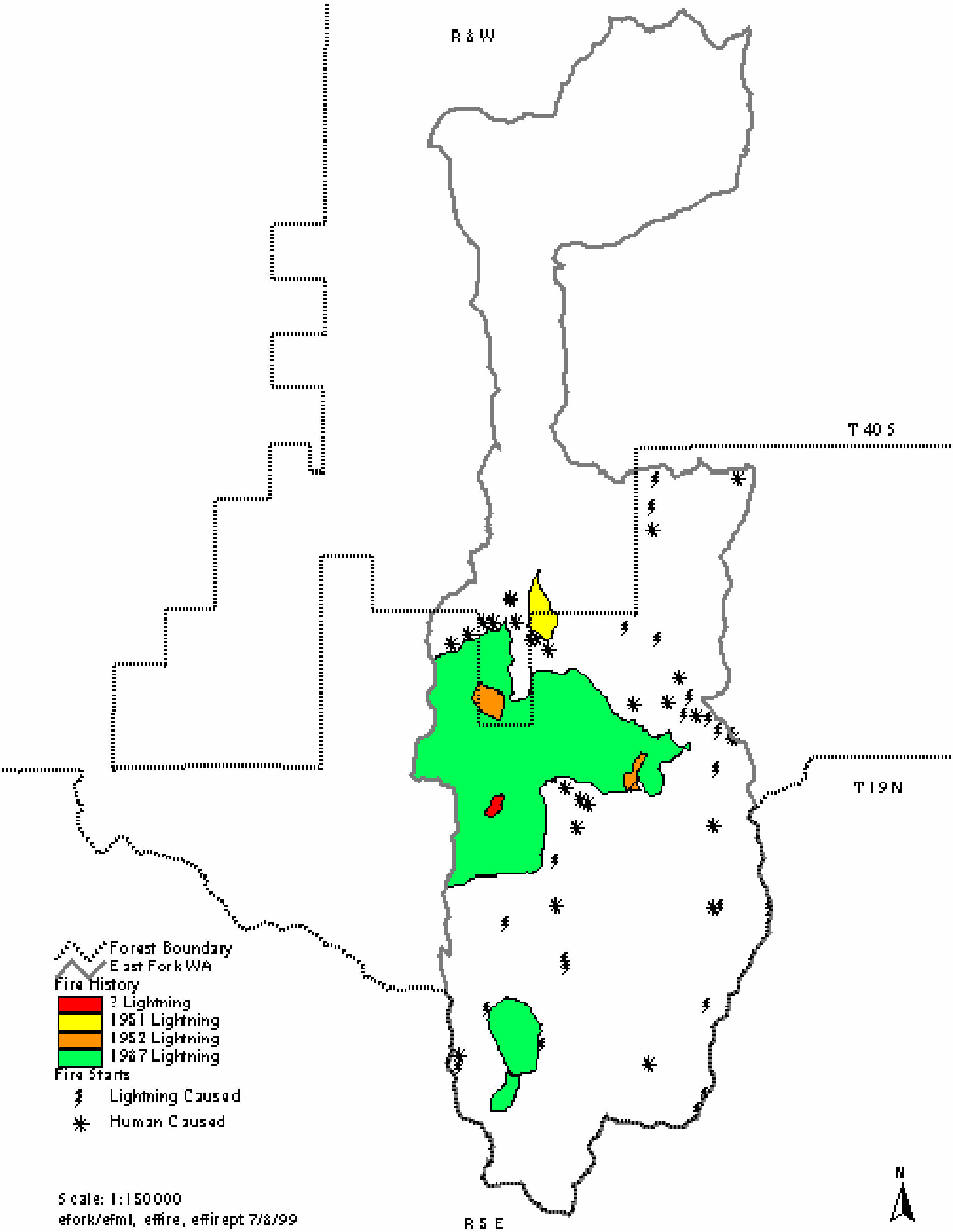
# East Fork Watershed Analysis
# Port Orford Cedar Detctions & Disease



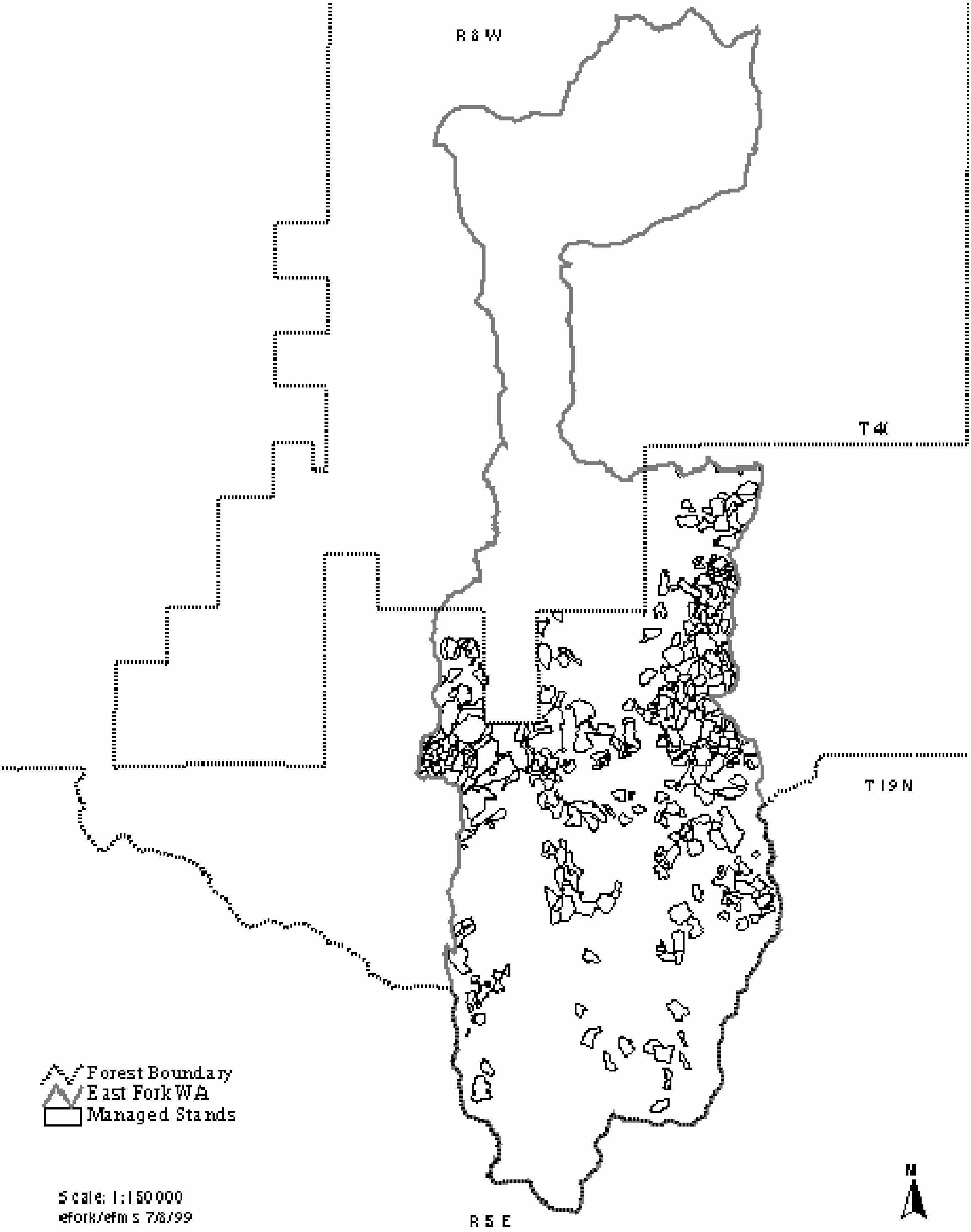
# East Fork Watershed Analysis
# Fuel Model



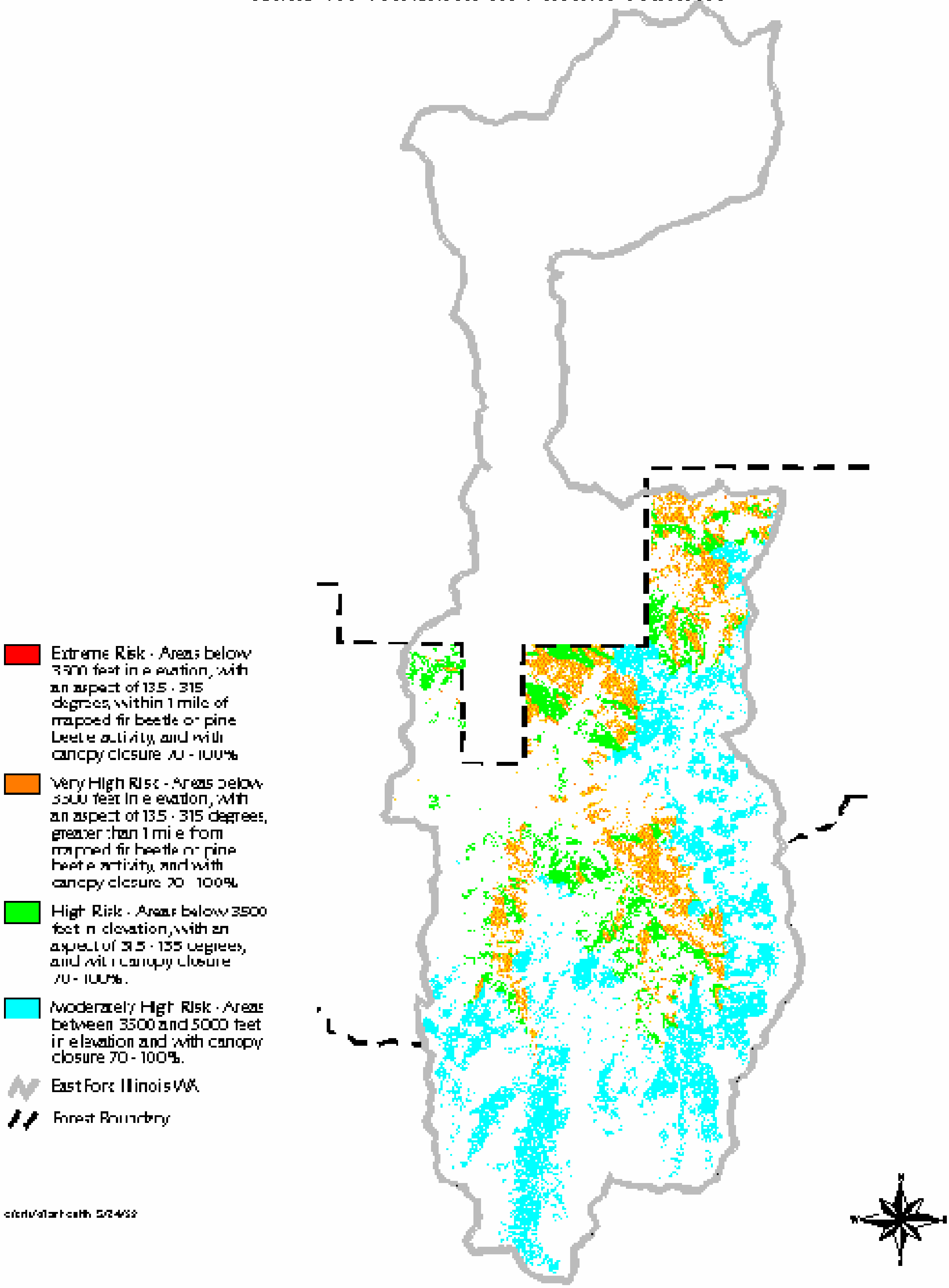
# East Fork Watershed Analysis
## Fire History



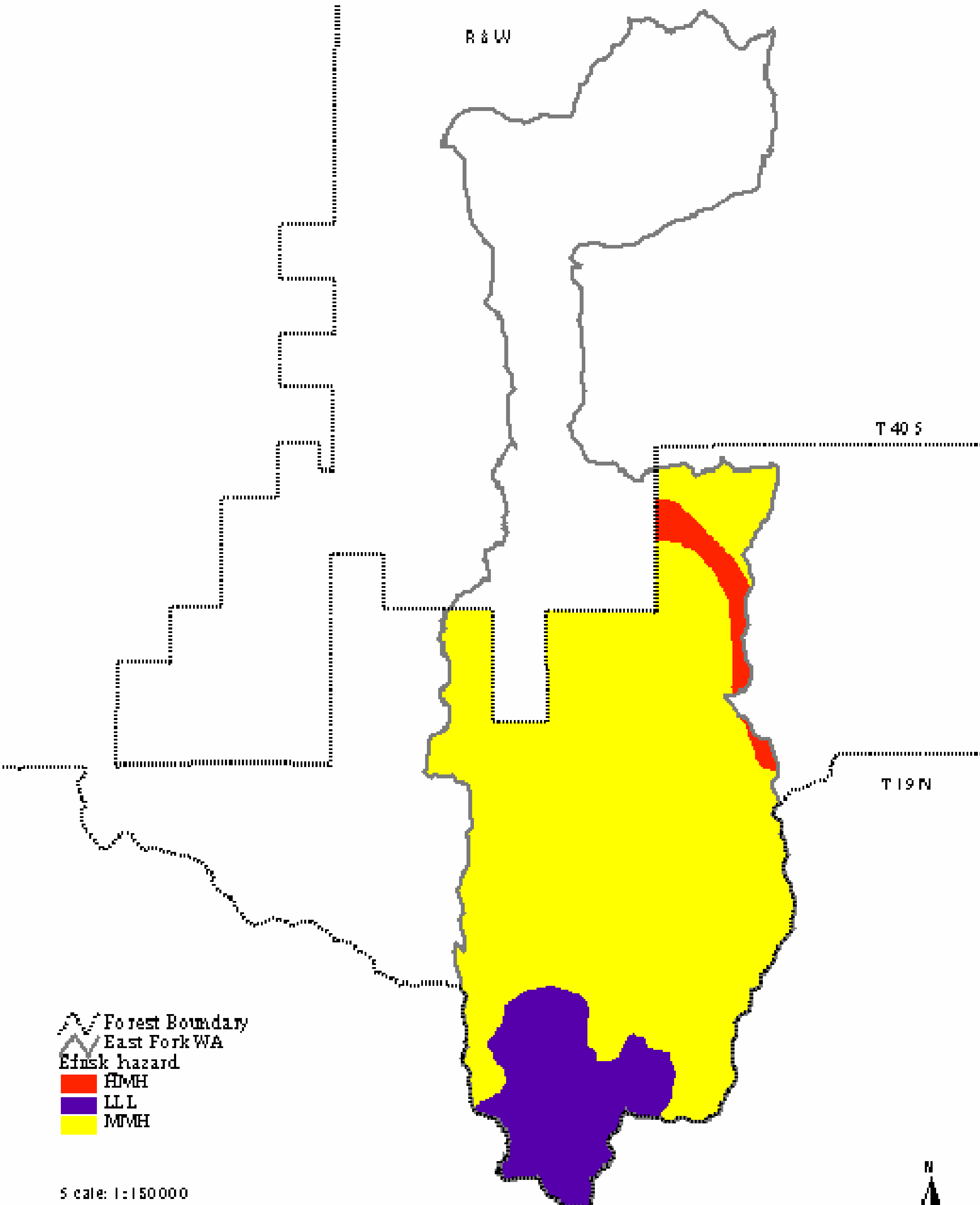
# East Fork Watershed Analysis
## Managed Stands



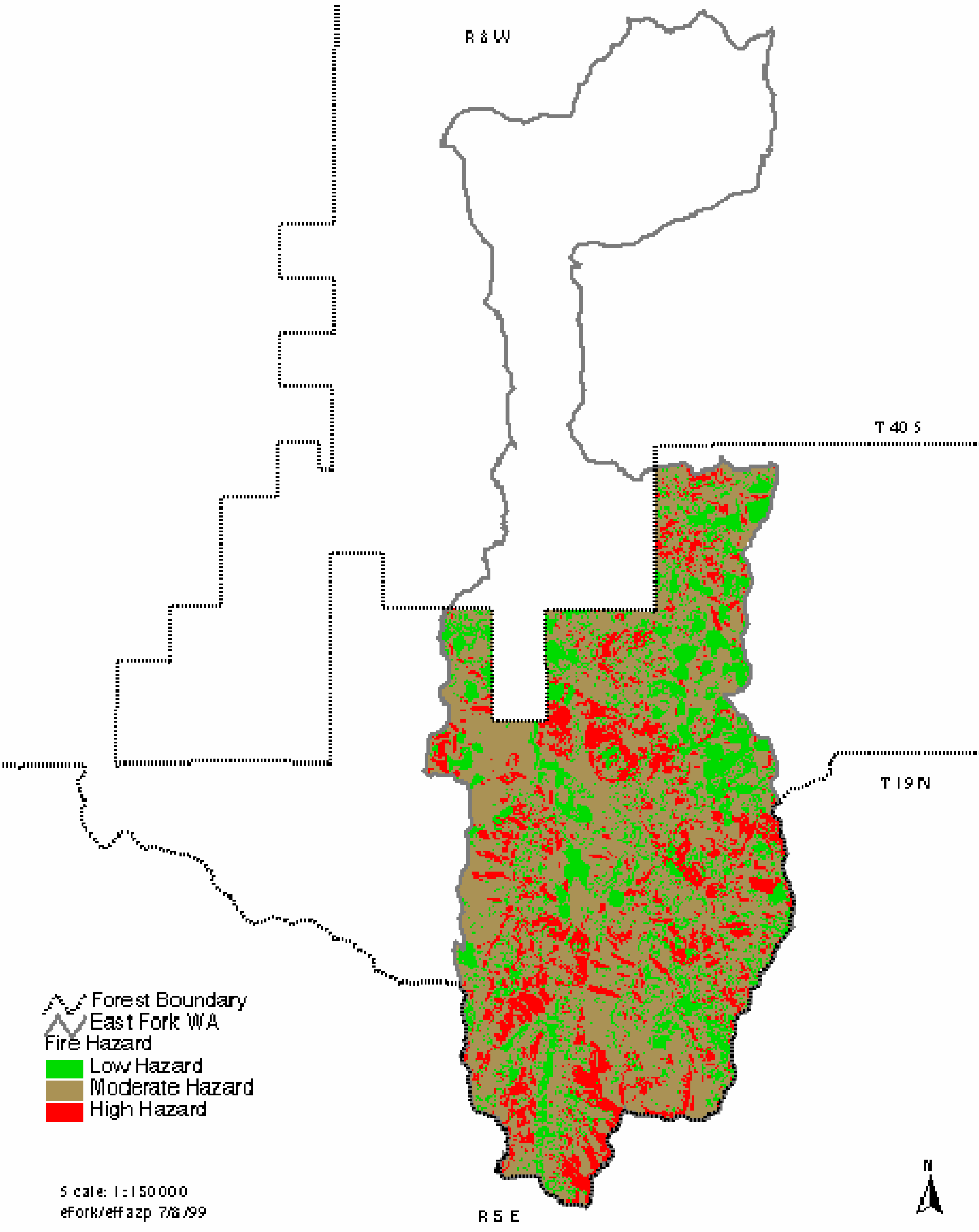
# East Fork Watershed Analysis
# Risk Of Decline In Forest Health



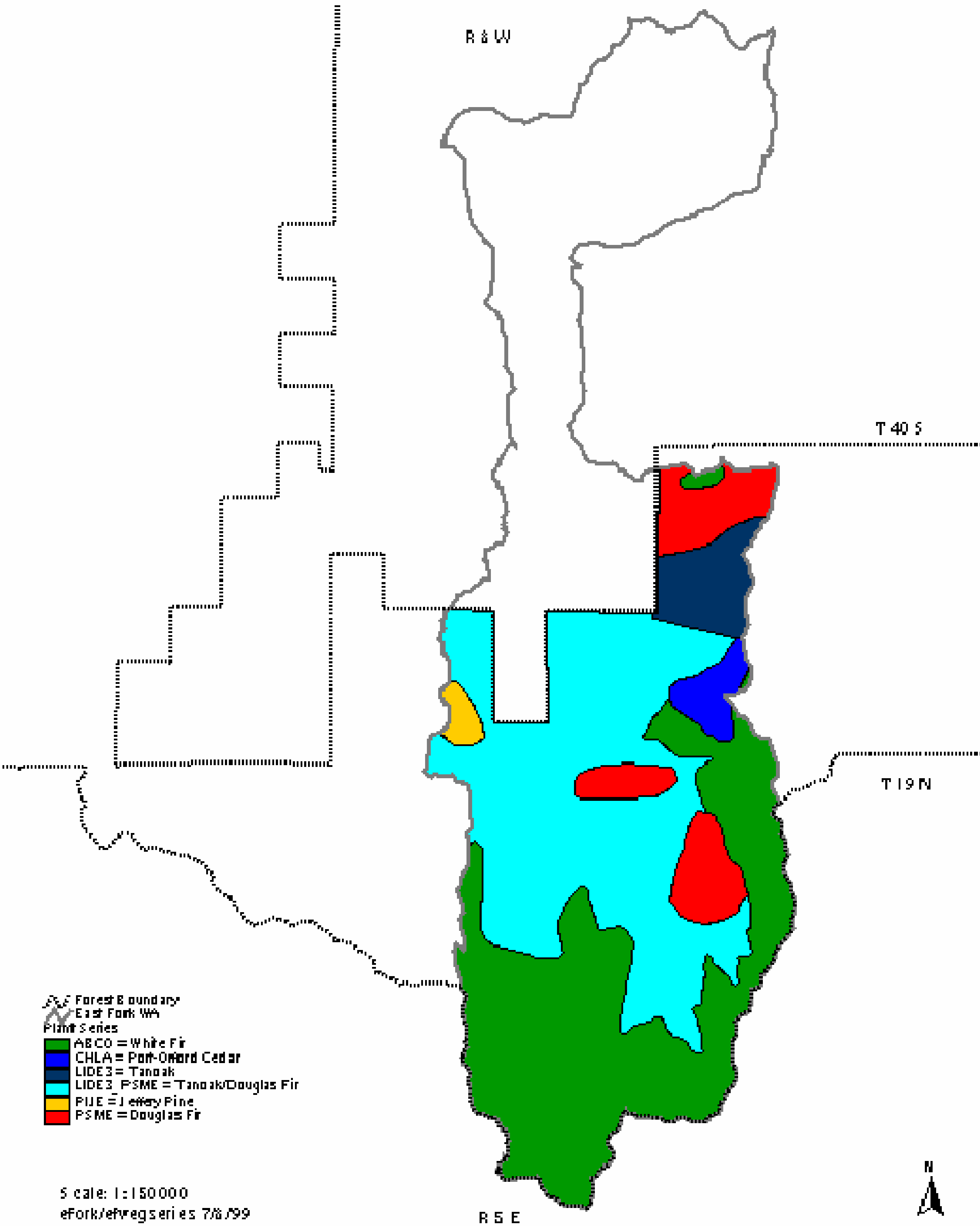
# East Fork Watershed Analysis
## Wildfire Risk Analysis Map



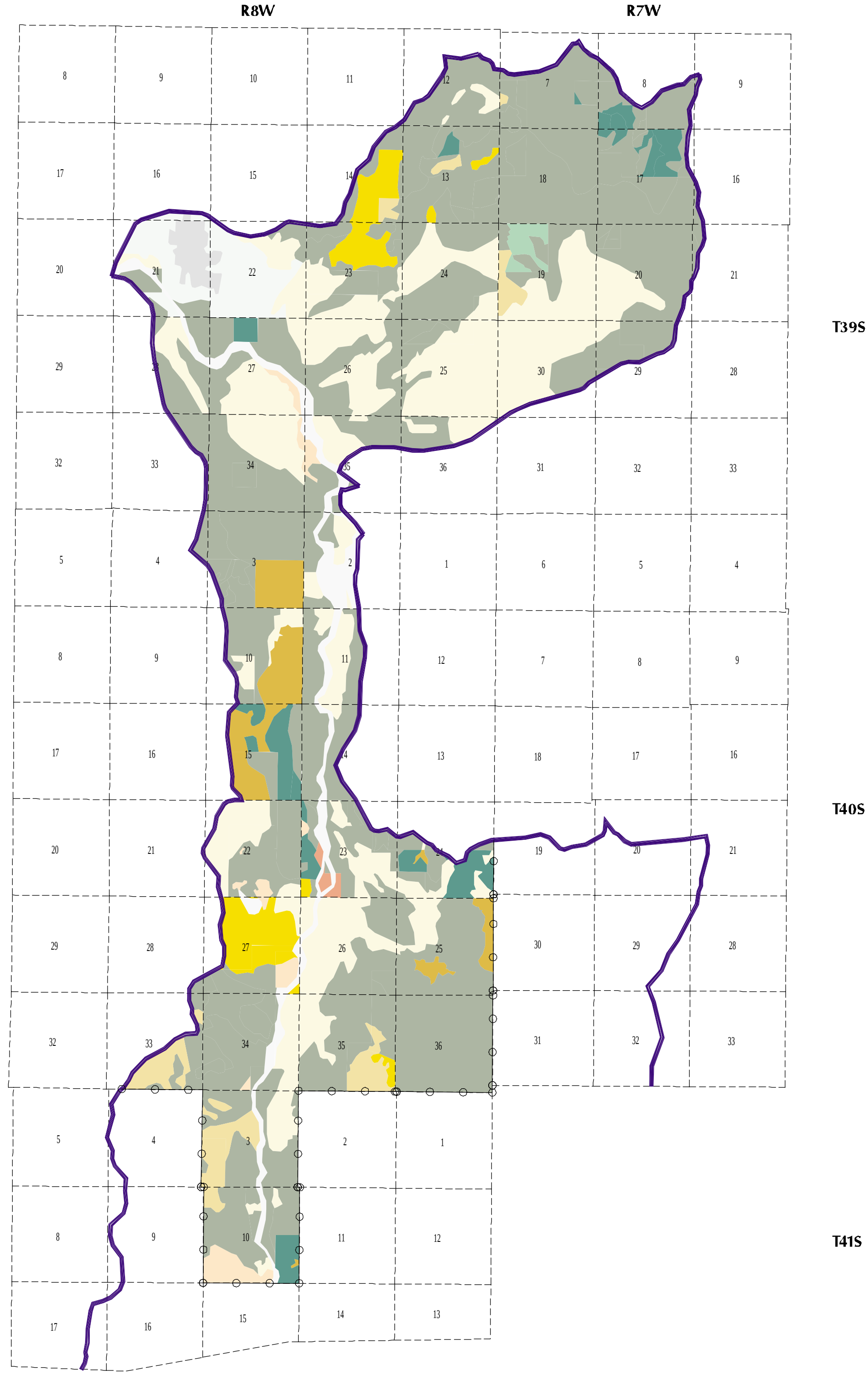
# East Fork Watershed Analysis
# Fire Hazard Levels



# East Fork Watershed Analysis
## Plant Series




Scale: 1:150000
eFork/efvegseries 7/8/99




SCALE 1:110000

# DOMINANT VEGETATION ON LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

## LEGEND

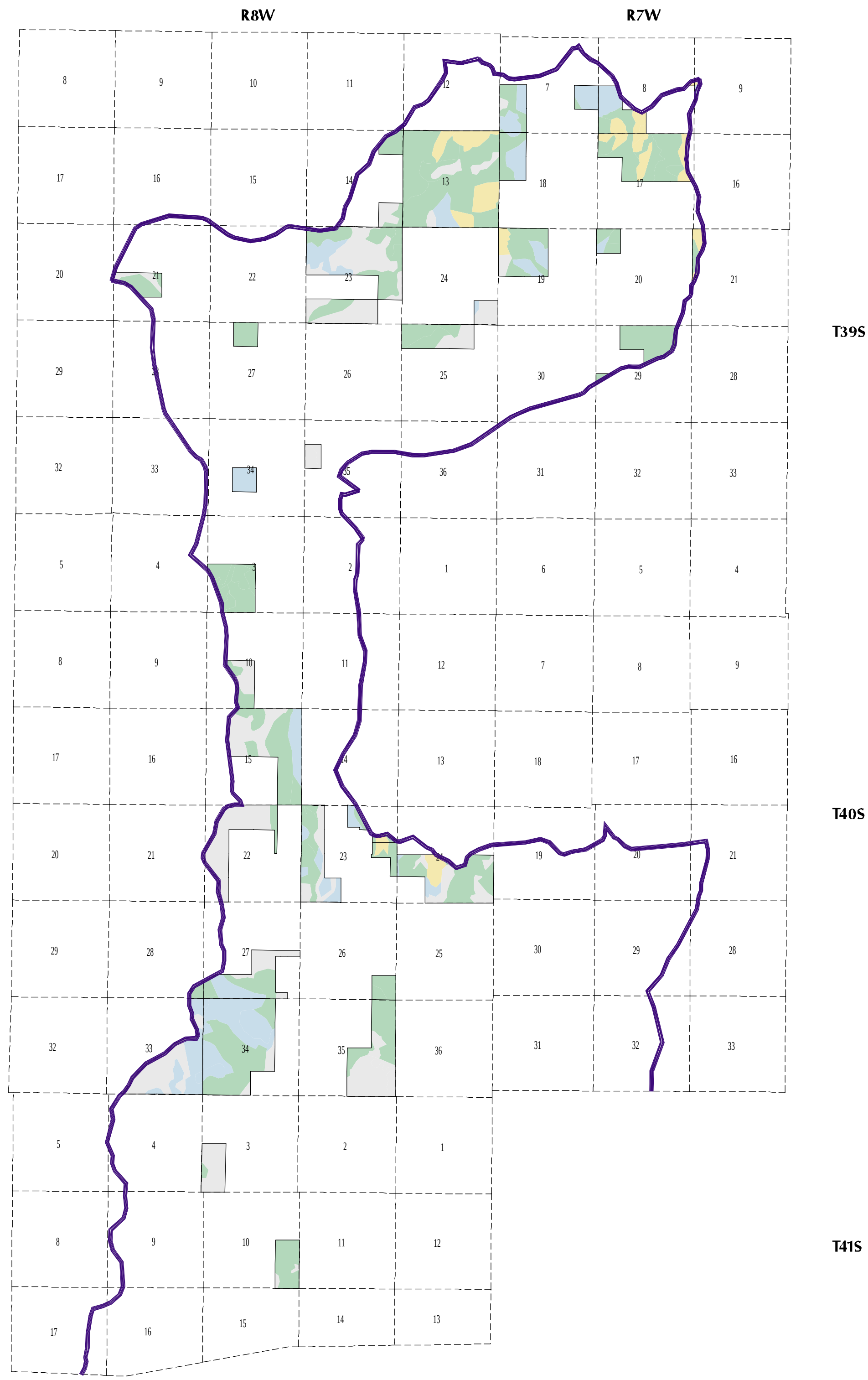
- NON-VEG.
- GRASS
- HARDWOOD/ CONIFER
- J.PINE/ SHRUB
- WATERSHED BOUNDARY
- DEVELOPED, NON-VEG.
- SHRUB
- P.PINE/ GRASS
- D.FIR/ PINE
- USFS BOUNDARY
- DEVELOPED, VEGETATED
- HARDWOOD
- J.PINE/ GRASS
- D.FIR

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

John McGlothlin

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.




SCALE 1:110000

# SERAL STAGES
# ON BLM LAND
# IN THE EAST ILLINOIS WATERSHED

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

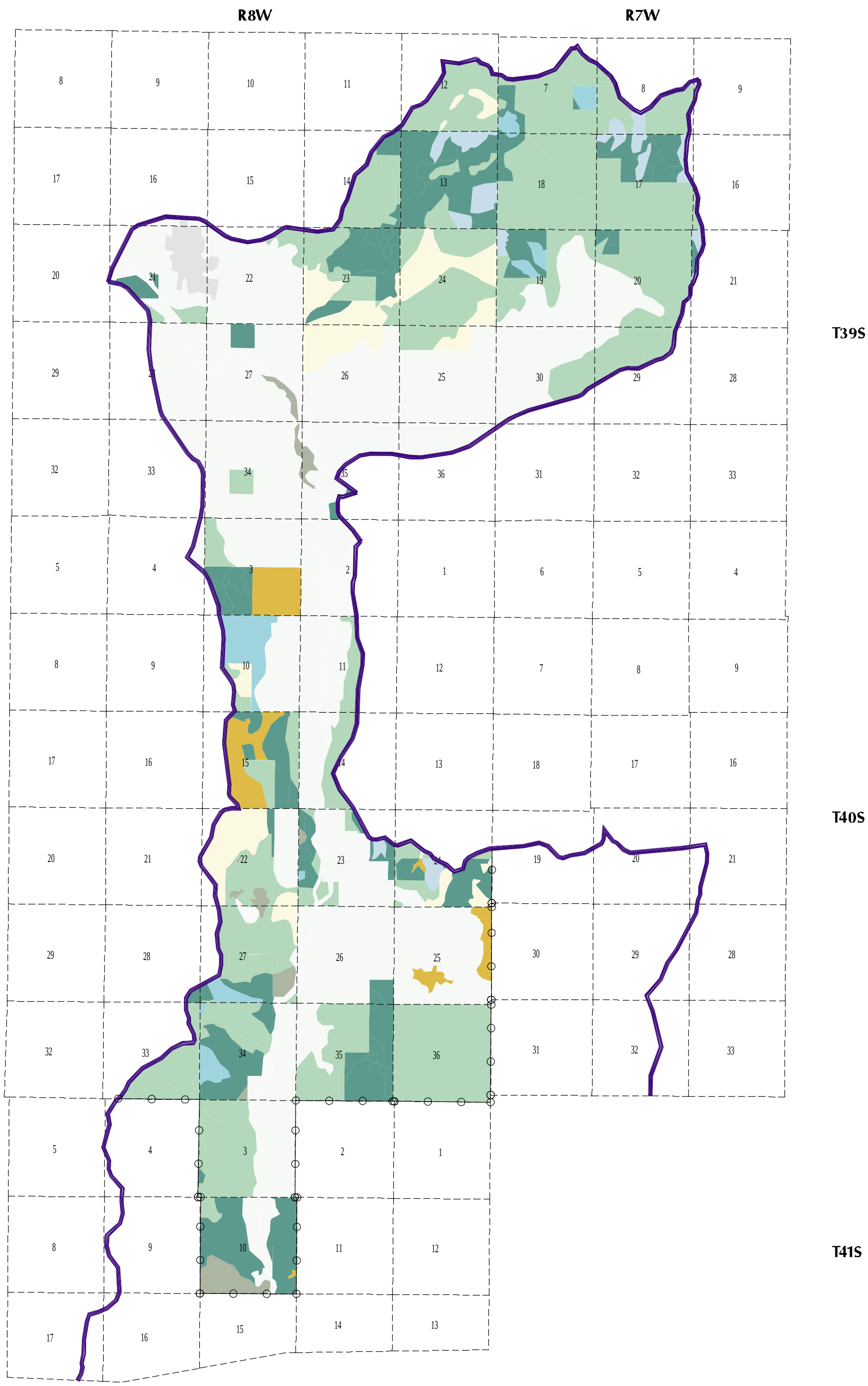
John McGlothlin

**LEGEND**

- MATURE
- MID
- EARLY
- NOT APPLICABLE
- WATERSHED BOUNDARY

N

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.




SCALE 1:110000

# VEGETATIVE CONDITION CLASS ON LANDS OUTSIDE THE USFS BOUNDARY IN THE EAST ILLINOIS WATERSHED

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

August 1999

John McGlothlin

LEGEND

- NON-VEG.
- DEVELOPED, NON-VEG.
- DEVELOPED, VEGETATED
- GRASS
- SHRUB
- HARDWOOD
- SEEDLING/ SAPLING
- POLES
- MID-SERAL
- MATURE
- WATERSHED BOUNDARY
- USFS BOUNDARY

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.